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ABSTRACT

Designed to evaluate the effectiveness of active learning games in the enhancement of selected academic operations among Negro and Mexican-American children, the investigation involved 127 children (mean IQ 85, in grades 1 through 4) from the inner city in Los Angeles who were identified as low achievers. The children were divided into four groups receiving the following treatment in addition to their regular curriculum: a supplementary program of physical education, special small group tutoring within the classroom, sequenced learning games, and no additional treatment. At the end of the 18-week project, results indicated that the children in the Learning Games Group showed significantly greater alphabet learning, self control, serial memory, and motor ability when compared with all three other groups. No signficiant sex differences or changes in measurable IQ were revealed. (RD)

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THE EFFECTS OF A PROGRAM OF LEARNING GAMES UPON SELECTED ACADEMIC ABILITIES IN CHILDREN WITH LEARNING DIFFICULTIES

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Evaluation of a Program Grant awarded by the U.S. Office of Education, (0-0142710)(032). Under the Jurisdiction of the Bureau of Handicapped Children.

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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BJC MMM

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CHAPTER I

INTRODUCTION

Throughout recorded history various forms of physical activity have found their way into educational programs. In past centuries the claims concerning the worth of movement experiences in school programs have at times been global and imprecise in nature. Eighteenth century naturalists, spawned by Renaissance idealism, believed that the spirit of the child was nourished if forms of free play and expressive movement were placed in the educational program. The first attempts to educate and change the nature of retarded children by Seguin (65), Itard (35) and Guggenbuehl (69) and others was nurtured by these seeds of intellectual awakening in Europe during the past century.

In Rome, shortly after the turn of the 20th century, Maria Montessori advocated the use of manipulative and tactual experiences as important learning channels. More recently various movement experiences have been advanced by Grace Fernald, Delacato (25), Barsch (7), Kephard (41), Getman (29) and others (19)(34) for the improvement of children with learning difficulties. The effectiveness of various programs of physical education have been studied by Oliver (51), Corder (16), Solomon and Prangle (68), Rarick and Broadhead (57), and others (73)(76) using retarded children as subjects. James Humphrey has also recently investigated the manner in which games might contribute to the ways in which normal children acquire arithmetic and language skills (34).

Using program content as a criterion, these various approaches may be placed into three groups.

1. Those containing traditional physical education activities, games, exercises and the like. [Corder (16), Oliver (51), Solomon and Prangle (68) and Humphrey (34)].

2. Programs involving highly structured gross motor activity [Delacato (25), Kershner (42), Robbins (60), Yarborough (74), Kephard (41), Brown (10), Rutherford (64) and Anderson (4)].

3. Tactual-manipulative activity [Montessori (47) and Grace Fernald].

Theoretically these programs may be classified as follows:

1. Some are based upon various cognitive theories. Their proponents suggest that movement activities which provide thought may indeed improve intelligence. [Humphrey (34), Rarick and Broadhead (57), Cratty (19) (17)(24) and Mosston (77)].

2. Other programs rest upon a "dynamic" theory. It is suggested that improvement in academic and intellectual processes will be derived indirectly; i.e. that

motivating and successful experiences in play realized by children in turn heighten self-concept and a willingness to "try harder" in academic tasks.

3. Another type of theory has spawned programs based upon a kind of lamination concept. Advocates of this position write that learning stems from perceptual development which in turn rests upon the early and complete enhancement of movement capacities. [Getman (29), Kephart (41) and Barsch (7), Smith and Carrigan (67)].

4. A theory of cortical integration is also seen in the literature [i.e., movement activities at various developmental levels will somehow improve the functioning of various parts of the central nervous system which in turn will positively influence other peripheral processes (vision, audition etc.) reputedly mediated by the same portions of the brain which were purportedly improved by the motor functions practiced (25)].

In general recent research evidence fails to support the validity of the various theories of perceptual-motor training. for example, in studies by Roach (59) and Brown (10) no significant differences in academic achievement and in reading were realized by their experimental groups exposed to the Kephard program. Other studies of this nature have also been reviewed by Cratty (23). Cawley, et.al.,in a factor analysis of perceptual and motor qualities indicated that they were neither associated with nor predictive of reading problems in groups of normal children as well as in groups of retarded children. (15).

Fisher, in an investigation finished in 1969, also produced findings which suggest that Kephart's assumptions and training procedures are less than helpful. He found, for example, that a short-term structured program of training in the perceptual-motor activities following Kephart's suggestions had no effect upon the perceptual-motor performance,academic achievement or intellectual functioning of educable mentally-retarded children. Fisher suggests, however, that his data does indicate that this training proves marginally effective in improving the perceptual-motor performance of educable mentally-retarded children who are younger than 10 years of age (70).

Recent research similarly suggests that the validity of the central theory of neural-motor integration espoused by Delacato is questionable. Robbins (60), Anderson (4) and Yarborough (74), for example, all failed to find any appreciable gain in intelligence, reading or in perceptual functioning on the part of children who were given a program of cross-pattern creeping and crawling. As a result of this research the methodology has been widely condemned by professional groups in the United States and elsewhere (78)(23). The study by Kershner which presents positive findings contains several questionable conclusions.[1] (42).

Research during the past ten years is only partially supportive of a "dynamic theory" of motivation relative to improvement of academic and intellectual functions through movement. Although the findings by Oliver in 1958 (51) and later by Corder (16) suggest that I.Q. gains may be achieved when retarded children are exposed to traditional programs of physical education games and fitness exercises, in later and more carefully controlled studies by Solomon and Prangle (68) and others (57)(73) in which the instructor "Hawthorne Effect" has been controlled for, it has been found that when a traditional teacher-directed physical education program is applied to retardates the improvement of motor functions will be seen (fitness, etc.) while no significant gain in I.Q. scores may be expected.

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[1] His controls improved more than his experimentals in an extensive battery of perceptual-motor tests and it was concluded that while the Delacato method was not supported with this finding, that the Kephart theory was. This kind of post hoc hypothesis formation is of dubious scientific merit.

Recent findings, it is believed, are more supportive of a central-cognitive theory of learning through movement. For example, a 1968 study by Rarick and Broadhead (57) utilized a physical education program in which the retarded children were given "movement problems" to think about. It was found, following this type of program of activities, that significantly positive gains in I.Q., measured by the Peabody Picture Test, were achieved by subjects in their experimental group.

Additional data supporting this position emanates from a study completed in 1969 by J.H. Widdop and his colleagues at McGill University in Montreal. They found significant changes in I.Q. measures collected from among trainable retarded children after participating in a program of movement education in which an extensive amount of decision making was encouraged on the part of the participants.(73)The program was, in part, modeled after the movement education approach in vogue in England during the past 15 years. Using normal children Humphrey similarly found that when games were used to teach arithmetic and language skills more improvement was realized than was attained by his classroom controls who studied the usual workbooks on these same subjects (34).

Summary

Thus, it is believed that as current research findings suggest, children may be taught to think more efficiently through movement to the extent to which they are encouraged to think about the movement activities they engage in.

Despite the apparent validity of the above statement however, it is often difficult to know just how to encourage children to think when moving or prior to performing a motor task. Additionally it is often more difficult to determine just what a child should or can think about while engaging in various physical activities.

Purpose

It was the purpose of this study to assess the possible effects of a supplemental academic program incorporating total body movements upon selected classroom operations including pattern recognition and discrimination, letter identification, serial memory ability and spelling.

Hypothesis

It was hypothesized that a program for retarded and culturally-deprived children encompassing total body movement will change performance scores reflecting a significant improvement in measures of impulse control pattern recognition, letter identification serial memory ability and spelling. Analysis of the data collected during the two phases of the study should lead to the answers to several pertinent questions:

1. Is the selection and sequence of activities to be employed valid? Is the order of difficulty of the various tasks reasonable?

2. To what extent will the activities outlined positively effect similar academic operations carried out in the classroom (i.e. spelling)?

3. What types of children (i.e., I.Q., age level, sex, etc./) are best started at what points in the sequence?

4. Will participation in the activities result in significant gains in the operations purported to be improved in their execution (i.e., impulse control, pattern recognition, serial memory ability and spelling)?

5. Will small group practice of various academic operations using movement games result in quicker and significantly higher levels of learning than will be elicited by similar practice carried out within the traditional classroom environment in groups of a similar size?

Rationale

The basic premises upon which this program was based are as follows:

1. Activities involving total body movement are fun. Motivating experiences of this type will elicit significantly more rapid learning of the skills practiced by the learning games group.

2. Total body movements in reaction to large and vivid stimuli can elicit quicker learning and more accurate responses on the part of some children who evidence learning difficulties than similar activities presented within a traditional classroom tutoring environment.

3. Children learn in a variety of ways; total body movement represents another learning strategy which by itself, and/or in combination with other modalities, may represent a helpful way to aid some children to engage in some academic operations more efficiently.

4. The operations incorporated in the games include practice in pattern recognition letter recognition and similar skills. These skills have been demonstrated to be significant predictors of reading success and at the same time the levels of competency exhibited in these tasks discriminate between groups of poor and good readers during the early primary years.(5) (15).

Definition of Terms:

Total Body Movement - The activities in most of the tasks incorporate movements of the total body through space via locomotor activity. The movement tasks incorporated into the learning activities in this investigation include skipping, hopping, running and jumping among others.

Impulse Control - Impulse control refers to the ability of the child to control voluntarily the movements and movement velocity of his body and body parts. The tests of impulse control utilized in this investigation have been suggested by the research of Maccoby and her colleagues (44).

Serial Memory Abilities - The ability to remember in the correct order a series of words, letters pictures, movements of another person (gestures and/or total body movements) and similar stimuli.

Pattern Recognition - The ability to identify verbally and visually various common geometric patterns.

Letter Identification - The ability to identify verbally and to write the 26 letters in the English alphabet, when presented as capitalized block letters and when seen in "lower case.

AN OVERVIEW

The program was divided into two phases. During the initial four month period a study was carried out to determine the validity and reliability of selected tests of serial memory ability, spelling, pattern recognition and attention span. The manner in which children may be introduced to the various program activities and methodological problems associated with utilizing the activities was also explored during this period of time. Twenty-nine subjects participated in this portion of the study.

The second part of the study employed four groups of children An experimental "learning games" group was exposed to a program of motor activities, directed toward the improvement of selected classroom skills. A second "physical education group" engaged in a program of traditional activities designed for elementary children and conducted for a similar four month period, to control for the expected Hawthorne Effect. The third "classroom tutoring group" obtained tutoring in small groups seated at tables, and did not engage in gross motor activity. Care was taken to allot to this group an amount of time in learning activities similar to the amount allotted to the "learning games group." A fourth group did not participate in any special tutoring or physical education of any kind.

It was thus hypothesized that the following would occur: the scores of the "learning games group" in the various sub-tests would reflect significantly more improvement than those of the "classroom tutoring group." It was further assumed that the scores of the "classroom tutoring group" would evidence more improvement than those scores of the "physical education group." It was also assumed that improvement indices of the control group that received special attention would be inferior to those of the other three groups.

What Follows:

The remainder of the monograph has been divided into the following sections. The sub-division following the Introduction, chapter (II), describes the initial pilot study which was carried out with 28 subjects prior to initiating the primary investigation. Procedures, findings and implications derived from the pilot study are contained in this section.

The next section (III) deals with the procedures employed, subjects utilized, and other pertinent methodologies utilized in the primary investigation.

The fourth section (IV) contains the findings and conclusions from the primary investigation. Included in this section are findings obtained when the test battery was subjected to a factor analysis, a survey of results of selected trend tests carried out during the course of the program, as well as pre- post-test comparisons using analysis of co-variance procedures. Various comparisons of the performance changes of various sub-groups within the subject population are also found in this section of the monograph.

Section V contains the educational and theoretical implications which seem to be indicated by an inspection of the various data collected. Also found in this fifth section are various suggestions for additional research on the problems dealt with in this study.

In the final part of the monograph (VI) is found a summary of the program, the findings obtained together with a brief survey of the implications of the findings. An appendix contains a description of the tests employed.

CHAPTER II

THE PILOT STUDY

The pilot study carried out prior to the primary investigation had two main purposes. First, it was purposed to establish testing procedures which would provide valid and reliable indices of selected academic operations (spelling, serial memory ability, pattern and letter recognition, etc.). Second, it was purposed to determine whether any significant change in these characteristics would occur following a program of learning experiences which incorporated activities requiring movement of the total body.

As this preliminary investigation incorporated no control groups, conclusions arrived at may only be inferential rather than positive. It is believed, however, that conclusions will be more positive with the introduction of a group controlling for the "Hawthorne Effect" (i.e., engaging in recreational activities), a group controlling for the perceptual training involved (i.e., learning in small groups while seated at desks), and, of course, a group in which no type of activities would be introduced, and which would only be administered tests before and after the training period to which the other groups would be exposed.

INITIAL PROCEDURES

An Overview

Preliminary procedures included contacting the administrators of Elementary Education for the Catholic Archdiocese of Los Angeles for permission to investigate the effects of the pilot-study program over a period of about six weeks. After this initial period of time, 29 children whose progress was "lagging" (a series of screening tests were administered informally at this point), were also given extra individual help. These 29 participated in extra one-half hour sessions on Tuesday and Thursday mornings in addition to the regular classes on Monday, Wednesday, and Friday.

At the end of a period of five months the 29 children were again tested on the battery of tests. Inspection of pre and post test data, as well as observations made while the instructional program was being conducted, formed a basis for recommendations pertinent to the improvement of the testing and instructional program to be used in the final study.

School Selection and Identification of Subjects;

The school selected, St. Malachy's, is located in South Central Los Angeles slightly north of the Watts area. Its population consists of about 90 percent Negro and 10 percent who have Spanish surnames and who will be considered in this chapter as Mexican-American. The averageincome for the families of the children attending St. Malachy's is from

$3,000 to $4,500 per year. Although the tuition charged is $10 per month, most of the children pay less and many are not charged anything for their education. The school has a well-stocked library and a large asphalt playground. The facilities for conducting the program incorporated into this investigation were located in a large combination auditorium-cafeteria (size 45' x 35').

The twenty-nine children selected for participation in the investigation were taken from the first through the fourth grades. The age range was from six to ten years, with a mean age of 7.73 (S.D. 1.19).

The children selected met the following criteria:

1. They were initially identified by their teachers as having academic difficulties including problems in learning to read, spell and giving their attention to classroom work.
2. Their I.Q. was 80 or below on the vocabulary section of the Gray Oral Reading Test.
3. They fell into the "low" category of the Metropolitan Reading Readiness Test, Form A.

Overall, the following chart summarizes the children of each sex, selected from each grade, 1 through 4.

Grade	Males	Females	Total
1	5	6	11
2	6	0	6
3	4	3	7
4	1	4	5
Total	16	13	29

One fourth-grade girl, one second-grade boy and one third-grade boy had Spanish surnames, the remainder of the children were Negroes.

Preliminary Testing

Twice within two consecutive days tests with six categories were administered to fifteen of the children. These tests consisted of tasks to evaluate:

1. Persistence (3 subtests)

   Walking Persistence

   A score was obtained by determining how long it would take a child to "walk around the square" (4' x 4'). The score was timed to the nearest tenth of a second and the child was stopped after three minutes if he continued that long. He was asked to move as slowly as he could.

   Persistence to Picture Book

   The time during which a child was willing to look at a picture book, Classroom Cartoons for All Occasions (Jerome C. Brown), was clocked to the nearest tenth of a second.

   Persistence at Ball Catching

   The examiner, using a regulation playground ball (8 1/2" in diameter), ten feet away, bounced a ball to the child to determine whether he would remain attentive to the task (i.e., continue to return it). The test was stopped if the child reached twenty catches and returns. The score was recorded in terms of the number of catches and returns the child engaged in before he stopped.

2. Perceptual-Motor Abilities (4 subtests)

The test purporting to evaluate balance, gross agility, locomotor agility and body perception (Levels I and II) from a battery employed in previous investigations by Cratty and Martin (24).

3. Pattern Recognition (2 subtests).

Visual Identification of Patterns

Cards (5" x 8") were held up one at a time for two seconds in front of the child. Each card contained one geometric figure (triangle, circle, square, rectangle, half-circle and diamond). The child was required to select and to point to the corresponding figure on a dittoed sheet containing all of the figures which were placed in front of him. The child was required to make his identification after the experimenter removed the stimulus figure. The score obtained was the number of correct responses; the maximum score possible was 6.

Verbal Identification of Figures

The procedures were the same as above except that the child was required to verbally identify the stimulus figures after they were presented one at a time. Scoring was carried out in the same way.

4. Letter Recognition (2 subtests)

Verbal Response

Block printed (upper case) letters were randomly presented one at a time on 5" x 8" cards for a two-second interval. Following presentation the card was placed face down on the table and the child was required to name the letter just exposed. One point was given if the correct response was given within two seconds following presentation. The total possible score was 26.

Written Response

Twenty-six printed lowercase letters were presented in the same manner as above, but in this test the child was required to write the letter within two seconds after each one was removed from his view. One point was scored for each correctly reproduced letter, and the maximum possible was 26.

5. Serial Memory Ability (2 subtests)

Memory for Pictures

Six pictures of animals (dog, cat, bird, fish, horse, elephant) were presented to the child. First a single picture, then two, then three, etc., until all six were presented. Between each presentation the child was required to repeat the names of the animals in correct order. The total possible score (all responses on all presentations) was 21.

Memory for Gestures

Six gestures were made by the experimenter in the same manner as above, i.e., "building up" from one, then two, then three, etc. until a total of six were seen. The child standing six feet away was required to imitate them in correct order and was afforded two seconds to complete each gesture. The gestures consisted of arm positions (i.e., arms folded, arms up, bent arms, etc.) as well as positions in which the hands touched various body parts (hands on shoulders, on top of head, touching ears, etc.). The total possible score or the total correct responses on all presentations was 21.

6. Spelling

Twenty words from the Dolch Basic Word List and from the Stanford Achievement Tests for Primary I were used. Each word was dictated at two second intervals and each child was permitted two seconds to begin to write or print the word. The first grade children were not given this test.

Analysis of the Data From Preliminary Testing

Rank order correlations were computed using fifteen subjects' scores between test and retest results as well as between selected subtest scores obtained in the initial testing session.

Using scores from retarded children, the subtests from the Cratty Battery of Perceptual-Motor Tests were found to be reliable in previous investigations and thus were not contrasted in this preliminary study ( )

In general the test-retest r's obtained from the tests of persistence were not high enough to justify their further use. Persistence in walking the square was not significant (r = .24), while persistence in ball bouncing was not computed as all but two of the children were content to remain with the tester for all twenty bounces, and the scores derived from clocking the duration of attention to the picture book on two trials was .68.

The reliability of the other tests met acceptable standards, with the exception of the verbal response to patterns and the serial memory tests, but it was hoped that with certain changes in the administration of these plus the addition of more subjects, reliability coefficients might become higher. Summarized, the correlations between test-retest scores in the various tests administered during this preliminary testing period are as follows:

Test	r
Cratty Battery	
Body Perception	.82
Gross Agility	.82
Locomotor Agility	.84
Balance	.80
Persistence	
Square Walking	.24
Ball Bouncing	not computed
Picture Book	.68

Test	r
Pattern Recognition	
Verbal Response	.89
Visual Recognition	.64
Letter Recognition	
Verbal (upper-case)	.98
Written (lower-case)	.93
Serial Memory	
Pictures	.79
Gestures	.73
Spelling	.96

Selected correlations computed (rank order) between the various tests revealed that significant (at the 5% level) relationships existed between the various scores obtained. For example, there was a +.58 correlation between the scores obtained from the test of visual recognition of patterns and the scores elicited from the body perception category. Similarly, there were a number of significant r's obtained when the scores reflecting proficiency in visual recognition of patterns were contrasted to other scores obtained (i.e. +.50 with verbal identification of patterns, +.54 with verbal identification of letters, +.79 with written identification of letters, +.64 with serial memory of pictures, +.53 with serial memory of gestures and +.59 with the spelling score). The data thus indicate the fact that pattern recognition may underlie the performance of a rather large number of schoolroom tasks.

There were other significant correlations obtained, including the following:

- +.50 between verbal identification of patterns and serial memory of pictures.
- +.82 between spelling and verbal recognition of letters
- +.69 between serial memory of pictures and the ability to write letters
- +.56 between ability to write letters and spelling.
- +.57 between spelling and serial memory of pictures.
- +.69 between serial memory of gestures and serial memory of pictures.

Data of this nature indicate that there are common elements in many of the tasks, including visual memory independent of the stimulus to be remembered, and serial memory ability independent of specific stimuli to be correctly ordered.

Revised Battery of Tests

As a result of the preliminary tests and analysis of the data obtained, a final battery of tests was constructed which excluded the tests of persistence used in the initial testing and substituted a test of line walking, i.e., "How slowly can you walk this line?" The child was clocked to the nearest tenth of a second.

Administration procedures of the other tests were made more exact and refined. The tests of serial memory ability were changed in the following manner: The child was started with three stimuli (either gestures or pictures), and the final presentation consisted of seven instead of six stimuli (i.e., gestures or pictures), as it was found that none of the children failed to name or imitate two stimuli in correct order and, at the same time, a number of the children in the preliminary testing could correctly order six stimuli.

The twenty-nine children selected for the study were tested and retested (the following day) on this revised battery.

A preliminary survey of the data revealed that the most difficult letters to identify orally were "Q" (missed by nine children), "U" and "V" (missed by seven), "J" (missed by six) and "D," "H," "L," "P" and "Z" (missed by five children). The most difficult letter of the lower case to write after it was visually presented was "q" (four children missed it).

The most difficult patterns to verbally identify included the half-circle, rectangle and diamond (each was missed by fifteen children) and the square (missed by eight). Only two children failed to identify a triangle, and only one could not name a circle when it was shown.

Tallies of the serial memory tasks revealed, as would be expected, the fact that the most difficult stimuli to reproduce were those within the middle parts of the series.

A summary of the mean scores and the correlations between the first and second testing sessions is seen in Table A. As can be seen, most of the tests reached acceptable levels of reliability, with the exception of serial memory of gestures and verbal identification of patterns. Learning affects are seen when contrasting the scores of serial memory for pictures and the persistence scores obtained in the first and second testing periods, although these shifts are not statistically significant because of the standard deviations obtained.

A correlation matrix was computed using the Pearson Product Moment Formula and is presented in Table B As can be seen, as might be expected, significant positive correlations were achieved when scores obtained from verbal recognition of letters were contrasted with serial memory for pictures (r=.71) and when spelling scores were compared to those obtained from the test of verbal identification of letters (r=.61). The ability to write letters and serial memory for pictures was also highly correlated (r=.82), as were the two tasks of serial memory (pictures and gestures r=.56).

An interesting negative correlation was obtained when the scores from the "attention" test were compared to the spelling test (r= -.57). This may have been indicative of the fact that many of the children are habitually underaroused for efficient learning, i.e., the slowest line walkers tended to be the poorest spellers.

TABLE /A

COMPARISON OF TEST-RETEST SCORES
USING TWENTY-NINE CHILDREN
DURING THE INITIAL TEST PERIOD
JANUARY 1969

	1st Testing		2nd Testing		r
	M.	S.D.	M.	S.D.	
1. Body perception	7.79	1.93	7.96	2.17	0.80
2. Gross agility	8.00	2.43	7.31	2.32	0.82
3. Balance	7.27	1.62	7.24	2.00	0.80
4. Locomotor agility	9.06	1.05	9.03	1.06	0.82
5. Persistence, line walking for time	26.00	9.00	30.96	15.46	0.80
6. Visual recognition of patterns	5.68	0.91	5.79	0.82	0.87
7. Verbal identification of patterns	2.82	1.16	3.00	1.11	0.71
8. Verbal identification of letters	22.72	5.45	22.86	5.49	0.99
9. Written replication of letters	24.72	1.72	25.03	1.61	0.88
10. Serial memory of pictures	20.51	6.23	22.06	5.47	0.81
11. Serial memory of gestures	22.86	3.22	22.93	3.20	0.69
12. Spelling (N-19) 20 words	10.00	5.07	9.36	4.55	0.95

TABLE B

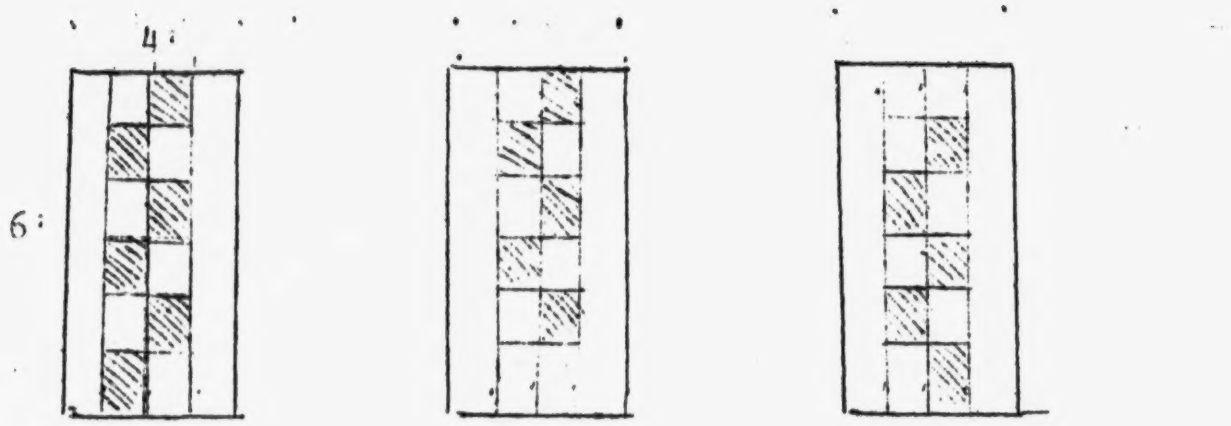
CORRELATION COEFFICIENTS BETWEEN SUBTESTS USED IN FINAL TEST BATTERY (N=29)

	1	2	3	4	5	6	7	8	9	10	11	12
1. Body perception	1.00	21.	.23	.59	.03	-.04	.27	.16	.34	.31	.03	.27
2. Gross agility		1.00	.18	.37	.14	.04	.05	.30	.28	.40	.32	.17
3. Balance			1.00	.16	.14	.00	.27	-.01	.30	.16	.02	-.15
4. Locomotor ability				1.00	.12	.31	.27	.17	.53	.40	.35	-.05
5. Persistence, line walking for time					1.00	.23	.08	-.05	.36	.32	.30	-.59
6. Visual recognition of patterns						1.00	.00	.01	.24	.21	.28	-.29
7. Verbal identification of patterns							1.00	.09	.17	.10	-.01	.07
8. Verbal identification of letters								1.00	.42	.71	.37	.61
9. Written replication of letters									1.00	.82	.36	.02
10. Serial memory of pictures										1.00	.56	.06
11. Serial memory of gestures											1.00	-.08
12. Spelling (N=19)												1.00

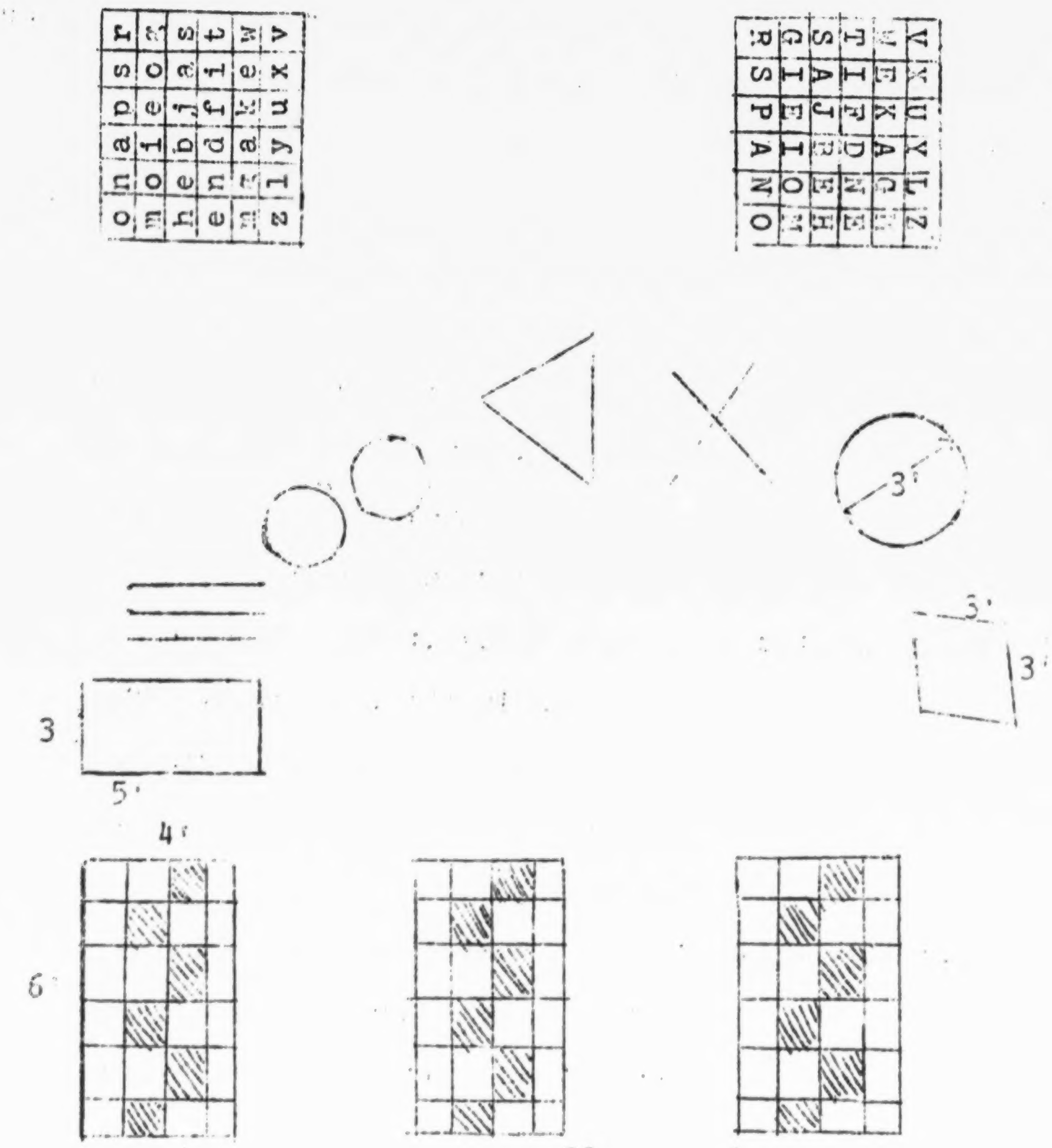
Other positive and significant (at the 5% level) correlations were obtained when scores from the locomotor agility test were compared to scores obtained from the body-perception test (r=.59), where gross agility was contrasted to locomotor agility (r=.37), and when locomotor agility was compared to the ability to write letters of the alphabet (r=.53). The last correlation may indicate some common element involving visual-motor coordination common to both jumping for accuracy into squares (leg-eye) and drawing letters (hand-eye).

Facilities and Equipment

The following patterns were painted on the floor of the cafeteria: a spelling grid containing upper case letters, a second grid containing lower case letters, and geometric figures constructed of yellow lining tape, as shown. In addition, three mats (4' x 6') were used which contained grid markings as drawn. Three rubber playground balls were also used, as were hoops and the like.



The space utilized measured thirty feet by thirty feet and the grids, mats and geometric figures were placed as shown.


o n a p s r
m o i e o g
h e b j a s
e n d f i t
m g a k e w
z l y u x v
O N A P S R
M O I E I G
H E B J A S
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M G A K E W
Z L Y U X V
3'
3'
3'
3
5'
4'
6'

PROGRAM PROCEDURES

Following preliminary testing as described in the previous pages, the children were separated into groups composed of five to six children each. Each group was taken from a larger class of forty students. The small classes met Monday, Wednesday and Friday for one-half hour each session. A total of five classes were conducted each of these days. The younger children in grades one and two were initially given tasks intended to reduce hyperactivity, to aid them in identifying body parts and the left-right dimensions of their body and in training in the alphabet, serial memory tasks and practice in pattern recognition. A typical lesson plan, lasting thirty minutes for this group, is as follows:

Eight minutes - Impulse Control Activities: "How slowly can you move?" "Tighten and relax your muscles."How loose can you make your muscles?"

Eight minutes - Pattern Recognition: "Can you run and stand in the triangle?" "Can you skip to the square?" "Can you walk around the triangle and count its sides?"

Five minutes - Serial Memory Practice: "Can you do the same things with a ball in each of the patterns as Jean did?'

Nine minutes - Alphabet Training: "Can you jump in the proper squares while saying the alphabet?" "Edward, watch Monica and tell me whether she is going to the letter I call out."

The older groups during this initial period concentrated upon tasks involving serial memory, impulse control, letter identification and spelling. A typical lesson plan for this group was as follows:

Six minutes - Impulse Control Activities and Relaxation Training.

Eight minutes - Serial Memory Practice.

Eight minutes - Letter Recognition, using grids.

Eight minutes - Spelling Practice: "Jump and spell the words I give you."

The content of the program was derived from several publications by Cratty and Martin and by Cratty (17)(18)(20)(24). The monograph Movement, Perception and Thought aided in perceiving the sequencing of various activities and in the rationale for the manner in which transfer of one cognitive skill to another might be achieved (19). Fifty game cards provided specific games and subskills which might be utilized in the numbered grid (19). Chapter 5, "The Adjustment of Arousal Level and the Improvement of Attention," in Perceptual-Motor Efficiency in Children, by Cratty and Martin provided a rationale and activities to be used when aiding the children to gain better self-control and to reduce hyperactivity (24).

Identification of Children Needing Special Attention

By the end of the second week it was becoming apparent to the teacher-experimenter that eight of the children needed special attention if they were to master the academic operations which confronted them. Thus these eight children were, in addition to the three-day-a-week class, given special help individually on Tuesday and Thursday for thirty minutes with the teacher-experimenter.

Mid-program Screening Test

Five weeks following the organizational change outlined above, all twenty-nine children were given pass-fail screening tests to determine the extent of the progress (if any) that was being made. These tests consisted of verbal memory of the alphabet, pattern recognition and left-right discrimination.

Final Organization of Instructional Program

For the remainder of the semester, March 28th until May 31st, all twenty-nine children remained in the groups taught Monday, Wednesday and Friday mornings and, in addition, the eight children who had been given special help were also afforded this one-to-one teacher-pupil ratio until the end of the semester (in addition to participating in the three-day-a-week group classes).

RESULTS

The findings are divided into three sections. First, group changes from pre to post test are described. Secondly, an examination of the children who initially scored lowest in several of the tests will be surveyed relative to the change evidenced in the posttest scores. The third section of the results contains several case studies in which children who scored lowest in several of the test categories are described and the changes evidenced in their posttests are discussed. Throughout the following section the reader must keep in mind that no adequate control groups were used and that the change described could be due to a number of factors independent of the teaching variables imposed.*

Group Changes

As can be seen in Table C , changes significant at or exceeding the 5 percent level of confidence were recorded on nine out of thirteen tests administered when the total group of children's scores were contrasted. Only in the tests of serial memory ability of gestures, in the visual recognition of various geometric patterns,

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*Instructor personality, learning how to take the tests, special attention accorded the subjects, etc. These variables will be discussed more thoroughly in the sections which follow

TABLE C

COMPARISON OF PRE- AND POSTTEST SCORES OF THE TOTAL SUBJECTS (N=29)

	Pretest		Posttest		t
	M.	S.D.	M.	S.D.	
1. Body perception	7.71	1.91	8.96	1.21	3.47*
2. Cratty Battery					
a. Gross agility	7.93	2.45	8.96	0.98	2.35*
b. Balance	7.18	1.54	7.97	1.38	2.59*
c. Locomotor agility	9.06	0.99	8.64	1.40	1.85
d. Gross motor total	24.14	3.13	25.61	2.26	2.72*
3. Impulse control	25.79	9.21	38.06	24.84	3.08*
4. Pattern recognition					
a. Verbal	2.79	1.15	5.50	0.82	12.40*
b. Visual	5.68	0.85	5.96	0.19	1.74
5. Letter recognition					
a. Verbal	22.61	5.50	25.00	3.06	2.97*
b. Written	24.68	1.68	25.64	0.75	3.35*
6. Serial memory ability					
a. Picture	20.36	6.26	22.57	4.95	2.52
b. Gesture	22.68	3.32	23.79	2.36	1.98
7. Spelling (N=19)	10.00	3.22	11.28	4.56	2.04

*Differences significant at 5 percent level.

in the locomotor agility subtest of the motor battery and in spelling words were significant changes not recorded. However, even when the pre-and posttest scores of these four tests were compared, the changes occurred in the expected direction.

The most marked changes were recorded in the children's ability to verbally identify various geometric figures, in their verbal identification of body parts, in their overall motor ability scores, in their serial memory ability for pictures and in their written and verbal responses to the visual presentations of letters of the alphabet.

The data indicates that, as a group, the children learned to move more slowly when walking the line in the test purporting to measure impulse control. As a group, too, they learned to better recognize letters of the alphabet when visually presented, and could write them and verbally repeat them more accurately following the educational regime imposed.

Pre- and Posttest Differences, by Sex

Tables D and E contain sex differences. Due to the small number of subjects in each group many of the differences are not statistically significant, and yet only one of the thirteen test scores (locomotor agility) obtained from both the boys and the girls failed to evidence change in the expected direction. Application of the nonparametric sign test, which evaluates significance in data on a plus-minus basis, clearly delineates the fact that improvement (a plus score) on twelve out of the thirteen tests is significant statistically (at the 5% level).

Analyzed by test, Table D indicates that statistically significant changes were recorded in pre- and posttest scores by the boys in measures evaluating the perception (verbal identification) of body parts, impulse control, the verbal identification of geometric figures and both verbal and written responses to letters (both letter recognition tests). Additionally, the boys' spelling scores improved significantly from an average of 7.4 out of 20 correct, to 9.1 correct, without specific practice on the words in the list used in the test.

The girls, on the other hand, evidenced significant improvement in tests evaluating body perception, impulse control, the verbal identification of the geometric figures and the ability to remember a series of pictures in the proper order.

When both the pre- and posttest scores were compared by sex, it was found that only in the measure of spelling competency were significant differences discovered. In both the pre- and posttests the girls were significantly better than the boys, as can be seen when comparing Table E and Table D (t=4.0 and 4.1 respectively). In all

TABLE D

COMPARISON OF PRE- AND POSTTEST SCORES
OF THE BOYS (N=17)

	Pretest		Posttest		r	t
	M.	S.D.	M.	S.D.		
1. Body perception	7.47	1.98	8.68	1.33	0.31	2.34*
2. Cratty Battery						
a. Gross agility	8.47	1.95	9.12	0.91	0.41	1.45
b. Balance	7.29	1.49	7.82	1.30	0.55	1.59
c. Locomotor agility	8.71	1.02	8.41	1.50	0.70	1.09
d. Gross motor total	24.47	2.96	25.41	2.51	0.72	1.81
3. Impulse control	27.00	10.35	39.57	27.52	0.60	2.20*
4. Pattern recognition						
a. Verbal	2.59	1.24	5.29	0.89	0.32	8.46*
b. Visual	5.76	0.55	6.00	0		1.72
5. Letter recognition						
a. Verbal	21.29	6.42	24.35	3.79	0.66	2.52
b. Written	24.53	1.43	25.53	0.79	0.14	2.61
6. Serial memory ability						
a. Picture	19.82	6.92	21.65	5.83	0.67	1.39
b. Gesture	22.94	2.92	23.47	2.73	0.54	0.78
7. Spelling (N=12)	7.42	3.89	9.17	3.89	0.77	2.18*

*Differences significant at 5 percent level.

TABLE E

COMPARISON OF PRE- AND POSTTEST SCORES OF THE GIRLS (N=11)

	Pretest		Posttest		r	t
	M.	S.D.	M.	S.D.		
1. Body perception	8.09	1.73	9.45	0.79	0.38	2.68*
2. Cratty Battery						
a. Gross agility	7.09	2.88	8.73	1.05	0.25	1.85
b. Balance	7.00	1.60	8.18	1.47	0.31	2.07
c. Locomotor agility	9.56	0.66	9.00	1.13	0.37	1.59
d. Gross motor total	23.64	3.13	25.91	1.78	0.17	2.06
3. Impulse Control	23.91	6.67	35.73	19.76	0.57	2.22*
4. Pattern recognition						
a. Verbal	3.09	0.90	5.82	0.577	0.39	10.03*
b. Visual	5.55	1.16	5.91	0.29	0.16	1.01
5. Letter recognition						
a. Verbal	24.64	2.54	26.00	0		1.71
b. Written	24.91	1.98	25.82	0.58	0.94	1.98
6. Serial memory ability						
a. Picture	21.18	4.97	24.00	2.56	0.85	2.87
b. Gesture	22.27	3.82	24.27	1.49	0.71	2.14
7. Spelling (N=6)	12.17	3.39	15.50	2.22	0.81	0.36

*Differences significant at 5 percent level.

the other scores obtained there were no significant sex differences when both the pre- and posttest measures were compared.

Analysis of Improvement of the Less Able Subjects

Although inspection of the data indicative of group changes presented on the previous pages might be considered highly encouraging, it also might be hypothesized that the improvement seen was evidenced only by children within the subject population who were close to the average score or above average in each of the tests administered. In other terms it might be assumed that the children of average and above-average ability (within this below-average population) showed improvement, while the extremely deficient child did not or could not under the conditions outlined.

In an effort to determine whether these less able subjects evidenced improvement the following analyses were made of children scoring within the lower one-third of the scores for the various tests and, in addition, individual analyses are made of the pre- and posttest scores of the one or two children who evidenced the poorest scores in the various tests given. Due to the small number of subjects within these less able populations, no formal statistical analyses were carried out, and the discussion is based only upon inspection of mean score changes.

Body Perception

Twelve children scored at 7 or below on the 10-point-possible body perception test. Thus these children evidenced an inability to correctly identify their left and right sides, arms and legs. Additionally, they could not cross their body and, for example, touch their left hand to the right knee.

These children were distributed between the various grades as follows: five were first graders, three were second graders, three were third graders and one was a fourth grader. Only one of the children was a Mexican-American (a third-grade boy), while the remainder were Negro children. Seven of the group were boys.

The average body-perception score of these children in their pretest was 6.08, while the posttest mean was 9.08 (S.D.s respectively were 1.7 and 2.2). Thus it appears that the group as a whole improved to a marked degree, and when the program was completed could achieve almost a perfect score on a test of body perception which included making complex left-right judgments about their body parts.

The lowest scorer in this test was a first-grade boy who scored 1 (out of a possible 10 points) the first time he was exposed to the test. His final score, following the educational program, was 8.

Motor Ability Traits

Three tests of motor ability were administered: one a test of balance and two agility tests. One of the agility tests evaluated the ability to hop and jump with accuracy (locomotor agility) and and the second purportedly reflected what was termed "gross agility," which was composed of two subtests evaluating a child's ability to move up and down rapidly and accurately (i.e. "How fast can you get up?") from a back-lying positioning.

Gross Agility

Eight children - three first graders,one second grader, one third grader and two fourth graders - scored 7 or less out of 10 possible points on this test. Five were girls and two were boys. (In previous studies it was found that boys did better on this measure, as one of the subtests involves leg power and abdominal strength usually found to be better in even younger boys.) All of these low-scoring children were Negroes.

The pretest mean for this group was 4.5, while the final mean was 8.6 (exceeding the norm for children of this age group). The distribution measures (S.D.) were 1.7 and 1.1 for the pre- and posttests respectively. The two lowest scorers in this test, a first grade girl and a fourth grade girl achieved a score of 2 in the pretest, while their final scores were 7 and 9 respectively. Again these two lowest achievers also had final scores which equalled the norms for children of their age and sex.

Balance

Twelve children scored a 6 or below on the balance test (10 points possible). A score of 6 generally indicated inability to engage in a one-foot stand with eyes closed for any length of time, a task usually not possible for children under the age of seven. Thus, as would be expected, one-half of these twelve low-scorers were in the first grade, two in the second grade, three in the third grade and one in the fourth. Also, as would be expected, seven of these twelve children were boys. Two of these twelve children were Mexican-American, a second-grade boy and a third-grade boy, with the remainder Negro.

The pretest mean score of this low-ability group was 5.7 (S.D. .61) and the final mean score they posted was 7.5 (S.D. 1.40). The lowest scores in this group posting initial scores of 5 were a first grade boy, a second grade boy and a fourth grade girl, and they all had final scores of 7 on this test.

Locomotor Agility

Nine children scored 8 and 7 on the locomotor agility test (top score of 10 points). These consisted of three first graders, four second graders, one third grader and one fourth grader. Eight out of these nine children were boys, as would be expected.* Two of the nine children were Mexican-American and the remaining seven were Negro.

The initial mean of this low ability group was 7.7, while the post test mean was 7.4 (S.D.s were .43 and 1.34, respectively). These data thus indicate that no significant improvement in this attribute was evidenced however, it should be remembered that, in general, the initial scores of these so-called low ability groups were superior to norms collected from Caucasian children, and thus little improvement was expected.

The two children scoring 7 initially on this test were both first grade boys, and their second scores were 6 and 8.

Total Motor Ability Score

A total motor ability score was computed by combining the three scores discussed above, so that the maximum possible score was 30. Eight children scored 23 or less points on this combined test. Four of these were first graders (two boys and two girls) two second graders

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*Generally, most studies have shown that boys are inferior to girls in tasks of this nature, indicating either superior neurological maturity or reflecting the inclination of girls to participate more and for more extended periods of time in activities such as hopscotch and the like, than boys.

(boys) and two fourth graders (girls) All of these low-scoring children were Negroes.

The initial mean score of this low-scoring group was 20.22 (S.D. 1.98), the final mean score posted was 24.44 (S.D. 2.4). The lowest-scoring children were a first grade boy with a score of 16 (out of 30 possible), a first grade girl with a score of 18 and a fourth grade girl with a score of 19, and three posted final scores of 25, 27 and 19 respectively.

Impulse Control

The test of impulse control was obtained by asking the children to walk a line twelve feet long "as slowly as you can." It was assumed that the children exhibiting less well-developed self-control would walk it fastest, while the children exhibiting "good" impulse control could, or would, walk more slowly.

The range of the scores obtained was 14 seconds to 52 seconds. The poorest scores were evidenced by eight children who walked the line in 19 seconds or faster. Four of these were first graders (three boys and a girl) one a third grader (girl) and three fourth graders (two girls and a boy). All of these children were Negroes.

The initial mean of this "fast-moving' group was 17.25 seconds (S.D. 2.04), while the final mean was 20.70 seconds (S.D. 8.9). It should be noted that the distribution measure changed significantly the second time the test was administered, thus the effects of the training appeared to have highly individual influences upon these children.

The fastest children included a fourth grade boy moving along the line initially in 14 seconds and two first grade children (a boy and a girl) who walked the twelve feet in 15 seconds. They posted final scores of 7.2 18.5 and 18.0 seconds respectively, which further emphasized the highly individual nature of the change elicited in various children.

Pattern Recognition, Visual Comparison

Most of the children could visually recognize and correctly compare six geometric patterns. Twenty-four could do this perfectly, while only three missed one of the patterns. The task consisted of observing various patterns presented one at a time by the experimenter and then pointing to the corresponding pattern on a sheet placed in front of them.

Two children, however, seemed to have difficulty in this task during this first test period (a fourth grade boy and a fourth grade girl). One could only visually identify two out of the six correctly, while the second compared four out of six correctly. On the final testing both of the children achieved perfect scores on this test of pattern recognition.

Verbal Identification of Six Geometric Patterns

More difficult for the twenty-nine children was the correct naming of the six common geometric forms presented to them one at a time. Eleven out of the twenty-nine, for example, scored 2 (out of 6) or below on this test, while one child, a fourth grade boy, could not name any forms correctly in the initial test of this attribute. Three of these eleven low-scoring children were first graders, two boys and a girl; three were second grade boys· three were third graders, two boys and a girl; and two were fourth grade children (a boy and a girl.) All three Mexican-American children in the twenty-nine-child sample were in the low-scoring group in this test. The remaining eight were Negro.

The initial mean score of this low-ability group was 1.63 (S.D. .64), while the final mean of these eleven children was 5.18 (S.D. .94). Thus, by the final testing, the children as a group could verbally identify 5 out of the 6 geometric figures correctly, while their initial testing revealed that, on the average, they could only identify 2 out of 6 correctly. The lowest-scoring children were a third grade boy who could not identify any of the figures verbally and a second grade boy and a third grade boy who could only name one. The final score of all three children was 5 out of 6 geometric figures correctly named.

Letter Recognition

Two tests of letter recognition were given. In one the child was asked to verbally identify uppercase letters presented one at a time and then removed from view while the child attempted to name them. The second was a test of the child's ability to write lower case letters presented in the same way and then removed while the child attempted to write them one at a time.

Verbal Response to Uppercase Letters

Eleven of the children failed to correctly name four or more of the letters. Five of these children were in the first grade (three boys and two girls), two in the second grade (boys), two were in the third grade (boys) and one was in the fourth grade (boy). None of these eleven children was Mexican-American and eight out of the eleven were boys.

The pretest mean of this low-ability group was 16.9 letters correctly named, while the posttest mean was 23.3 correctly named letters.

Three of these eleven children scored extremely low in this test. Two first graders (a boy and a girl) could only name 6 and 7 letters respectively when they were shown them, while a second grade boy could only name 14 correctly. Two of the three final scores of these children were highly encouraging. The child who initially could only name 7 letters correctly named all

26 letters the second time tested. The child who named only 14 correct initially got a final score of 22. However, the first grade boy who initially named only 6 letters in the first testing,posted a score of only 10 after the training period to which he had been exposed.

Written Response to Lowercase Letters

In general, the twenty-nine children posted better scores on this test of letter recognition, as their task was only to copy a lowercase letter after it was presented visually to them. It is thus uncertain whether the scores obtained reflected ability to copy geometric figures, or whether there was a real identification of the letters presented. In any case, eighteen of the twenty-eight children copied 25 out of 26 letters correctly, thus the low-ability group in this test consisted of children who scored 24 or below.

Four of these ten children were in the first grade (three boys and a girl), two were in the second grade (boys) and three were in the third grade (two boys and a girl). None of the low-ability group was in the fourth grade and one was a Mexican-American.

The initial score of this low-ability group was 22.66 (S.D. of 1.50); the final score of the group was 25.55 (S.D. 92). One of the children, a first grade girl, could only copy 19 out of the 26 lowercase letters correctly during the initial test period. Her final score was 24.

Serial Memory Ability

Two tests of serial memory ability were given, one in which the child was asked to duplicate a series of gestures and the second in which they had to name in proper order a series of animal pictures. A perfect score in each of these tests was 26.

Memory for Pictures

Ten of the twenty-eight children posted scores of 21 and below in this test. Six of these were first graders (three boys and three girls), one was a second grade girl, one a third grade girl, one third grade boy and the tenth a fourth grade girl. One of the ten was a Mexican-American child (the third grade boy) and the remainder were Negro children.

The initial mean score for these ten children was 14.10 (S.D. 6.8) and the final mean score for the ten children was 19.60 (S.D. 7.21). Four of the children posted extremely low scores. A first grade girl could remember only 1 (out of a possible 26), a third grade boy scored 4, another first grade girl had an initial score of 8 and a first grade boy had a score of 9 the first time they were tested.

The second time these four children were tested the child scoring 1 did not improve, the child scoring 4 initially had a final score of 20, the child with a first score of 8 had a second score of 16, while the child initially scoring 9 had a final score of 22.

Memory for Gestures

As a group the twenty-eight children remembered gestures better than they did a series of pictures. None of the children, for example, scored below 13 on this test (out of 26 possible) and one-half (14) had a score of 25. The "low-ability" group posted scores of 21 or less on this test and was composed of eight children. Four of the eight were first graders (two boys and two girls), one was a second grade boy, one a third-grade girl and two were fourth graders (one boy and one girl).

The initial mean score of this group was 18.00 (S.D. 2.54) and the final mean score was 22.25 (S.D. 3.56). The child scoring only thirteen initially on this test (a fourth grade girl) had a score of 20 the final time she was tested.

Spelling

The ten first grade children were not scored initially in spelling, as it would not be expected that they could spell any of the words on the list during their first semester at school. The low-ability group analyzed thus consisted of six children who only spelled from 2 to 5 words correctly out of the 20 which were presented to them. Two were second graders (both girls), three were third graders, of whom one was a boy, and two were fourth graders (a boy and a girl). One of the children was a Mexican-American, the fourth grade boy. The initial mean score of this group was 3.66 (S.D .94), while the final mean was 6.5 (S.D. 3.6). The size of the second standard reveals that the improvement in this attribute among these children was a highly individual matter. Analysis of individual scores among this group of six reveals the following:

Pretest Score	Posttest Score
2	5
3	3
4	11
4	5
5	12

It thus appears that only four of the six children improved to a marked degree in spelling ability. The implications of this finding will be discussed in the section which follows.

Summary of the Results

1. Group changes significant at the 5 percent level of confidence were recorded in the expected direction on nine out of the thirteen tests administered.

2. Significant improvement was recorded in scores reflecting body perception, three motor ability scores, a measure of impulse control, verbal identification of letters, the ability to copy lowercase letters, the ability to name common geometric figures and the ability to remember a series of pictures presented one at a time.

3. Significant improvement was evidenced by the boys in measures of body perception, impulse control, verbal identification of geometric figures and in both verbal and written responses to uppercase and lowercase letters presented one at a time. The boys' spelling scores improved significantly.

4. Significant improvement was evidenced by the girls in measures of body perception, impulse control, verbal identification of geometric figures and the serial memory of pictures.

5. Analysis of the scores of the less able children taking the various tests revealed that they evidenced marked improvement in the tests given, with the exception of spelling.

SUMMARY, CONCLUSIONS, AND IMPLICATIONS OF THE PILOT STUDY

Twenty-nine children with average I.Q.s of 75 were exposed to a program of total body movement purporting to enhance selected academic skills. The three-lesson-a-week program, lasting seventeen weeks, was preceded and followed by a program containing thirteen tests of academic and motor attributes.

The educational program consisted of activities purporting to enhance impulse control, body perception, serial memory abilities, letter and pattern recognition and spelling. The activities were those in which total body movement was involved and, for example, consisted of walking around triangles and counting the sides, remembering and performing a series of movements performed by another child, and jumping in grids containing letters of the alphabet.

Analysis of the group data indicated that significant positive changes in nine out of the thirteen tests had occurred. Further detailed inspection of the data elicited from children who scored low on each of the tests indicated that marked improvement had been evidenced in all of the tests, with the exception of spelling.

Although it might be concluded that the program of gross motor activity had a highly positive effect upon the attributes measured, it is believed not sound to form this type of conclusion in the absence of proper controls. The data do, however, offer highly interesting avenues for further investigation in which such variables as instructor rapport, visual inspection of the training facilities and the motivating effect of playing games are controlled for.

Many implications for further research and for improved teaching methodology arose from the data and from observations of the children and of the general teaching environment. For example, it was noted that teaching the names of the various geometric patterns may be superfluous academic exercise which leads nowhere. Unless transfer is specifically taught for, i.e. how a triangle may be modified to make the letter "A," the geometric patterns simply constitute additional "letters" for the children to learn and thus have little educational significance.

The lack of improvement in the spelling scores can be explained by the fact that spelling was only engaged in (by jumping into the letters on the grid) during the final week of the program. At the same time the data suggest that particularly with the younger and less able children, spelling of specific words must be concentrated upon or little general learning of how to spell is likely to occur.

Further studies should also illuminate whether practice in serial memory ability involving movements (of the body, or of limb gestures) is likely to transfer to other more academic serial memory tasks (i.e. remembering the order of letters in words). The present data suggest that serial memory ability is likely to be highly specific to the stimuli involved and to the manner in which the subject must replicate the series of stimuli.

It was also felt that the initial two weeks of the program were needed before the highly active children could be placed under some type of control and before any learning or learning games could be engaged in. Thus various exercises in impulse control and relaxation training were engaged in during these first weeks. Only after this instructor control was accepted by the children could additional exercises in impulse control and in learning games take place. It was thus believed that the general shape of the learning curve which was elicited (and which will be confirmed in future studies) was a positively accelerated one. The improvement in the various attributes trained for was greatest during the final weeks of the educational program administered.

A number of methodological implications arose from the instructors' observations. For example, it was obvious that the children were able to identify letters largely by their fixed location on the painted grids. In the future, it is planned to have movable letters placed on squares which can be transferred to various locations within the grid so that place cues are subordinate to the cues arising from the configurations of the letters themselves.

Within this same context, it is planned in the final study to require the children in the middle and upper elementary years to identify cursive letters in addition to lowercase and uppercase letters used in this study.

The lack of improvement in the ability to write letters on the part of many children indicated that the teaching techniques employed should be combined with various desk-top writing tasks for maximum transfer to various classroom operations required of the child. For example, after jumping in the proper squares, the child might then be asked to sit down and write the letters he has just "visited" via his locomotor efforts.

CHAPTER III

METHODS AND PROCEDURES, FOR THE PRIMARY PORTION OF THE PROGRAM

INTRODUCTION

The pilot study described in the previous chapter provided a great deal of valuable information. Specifically tests and testing procedures were refined. Some unreliable tests were discarded and others substituted in their place. Likewise, the scope of the testing program was enlarged and a number of tests were added. Most important, however, the pilot study provided an opportunity for the project administrators to improve teaching methodologies and to become better able to evolve procedures used with the children which were congruent with the needs and abilities evidenced by their changes.

In several ways the main investigation was similar to the pilot study. The duration of time a group of children was exposed to the learning games was one school semester in both parts of the investigation; the activities taking place within the classes were similar in both, while the number of classes in learning games per week, three, was alike in both the pilot study as well as in the primary investigation.

In other important ways, however, the primary investigation was conducted differently from the procedures used in the pilot study. For example, four groups of children were used in the final investigation, so as to control for the several types of variables which could have contaminated the pilot study. A group exposed to special small-group classroom tutoring was employed, as was another group in which the children were exposed to a structured physical education program. In addition to a "learning games" group, a fourth group of children was only exposed to the pre- and posttests, as well as to two intermediate "trend" tests, without any special academic attention, nor any special activity programs.

Two primary changes were made in the testing program in the final part of the study, as compared to the initial portion. The number of tests in the battery to which the children were exposed was enlarged and refined. They received only 14 tests in the pilot study, four of which were measures of gross motor ability; while in the final part, the number of tests was expanded to 19. Several of the motor ability items were excluded and evaluations of academic operations were substituted in their place.

A second change which was initiated in the final portion of the study involved monitoring the children's progress in all the groups by means of two series of trend tests administered at regular intervals during the semester. This shortened battery of 10 tests was meant to sample within a more exact time scale the progress or lack of it evidenced by various children within the experimental group and the three other groups. Thus by means of these trend tests the children's behavior was sampled every 5 weeks, instead of at an interval of 18 weeks, if only the pre and post program battery had been relied upon for data. The results of this trend testing thus provided deeper insights into "what was happening, and when."

The material in this chapter is placed into four categories. Initially a survey is made of how the children for the final part of the study were selected for inclusion in the program. Secondly, it is explained how the final testing battery, and the make-up of the trend tests, were constituted. The testing procedures and the rationale and reliabilities of the various tests are also covered in this section. Next, material relative to the manner in which the children were taught in the various groups is outlined. Techniques used in the physical education group, in the classroom tutoring group and in the learning games group are described in this third part of the chapter.

The chapter concludes with a brief description of the way in which the data was dealt with. A description of the manner in which traditional statistical tools have been employed, together with a survey of which smaller sub-group differences were examined is found in this fourth section. The way in which a "case" study approach was employed when examining the effects of the program on individual children is also contained in this final part of the third chapter.

SELECTION AND IDENTIFICATION OF THE SUBJECTS

Initially four schools were selected for inclusion in the program. These schools were located within the central city of Los Angeles and were recommended to us by officials within the Archdiocese office. Next, the project administrator together with a research assistant inspected the students' individual files in grades 1 through 4 at each school.

This initial review of school records revealed that one of the schools did not contain enough children whose scores on the Metropolitan Readiness Test (Grade 1), Stanford Achievement (Grades 2 and 3), as well as the Lorge Thorndike I.Q. Test for the 4th Grade survey, indicated that they might benefit from the program proposed. Thus children's records in a fifth school were surveyed. The results of the Gray Oral Reading Tests, administered to all grades (1-4), were inspected as a method of identification of prospective subjects within the schools decided upon. This same test was used as a basis from which to exclude one of the original five schools considered for the investigation.

Within the four remaining schools the following criteria were used to select subjects for the program:

1. The 48 first grade children selected were those scoring D or below on the Metropolitan Readiness Test. According to written interpretations of this test it is stated that a D in this test means that the child is "likely to have difficulty"; while an E score means that "chances of difficulty are high."

2. The 36 children in grade 2 were selected by inspecting their scores on the Stanford Achievement Test, (Form W, Primary I) (administered to those children in March of their first grade year). This test measures reading vocabulary and reading comprehension. The children selected for the program in the second grades at the four schools were those scoring below 2.0 (grade) in the Stanford Achievement Test.

3. The 27 third grade children selected were those who failed to achieve a score of 3.0 (ready for third grade) in the Stanford Achievement Test, Primary II. This test was also given to these children in March at the end of their second grade. Twenty-two of the 27 third grade

children selected for inclusion in the project from the four schools (82%) had not recorded second grade achievement levels on the Stanford test, (reading-vocabulary section).

4. The 29 fourth grade children selected for the project in the four schools scored below 3.0 on the reading-vocabulary section of the Iowa Test of Basic Skills. Thirteen of the 29 fourth grade children had posted reading-vocabulary scores at the first grade level (45%); while eight had scores in the reading-vocabulary section of the Stanford Achievement Test at the second grade level (28%). The remainder of the children posted scores of 3.0, third grade level.

5. Some of the low achieving children whose test scores were surveyed were not selected for inclusion in this study because they were already receiving help via federally sponsored tutorial programs.

Some of the children within these schools who probably needed special help were not selected for this program because of an absence of test scores occasioned by their frequent transfer from school to school. Poor attendance by many of the children during the days in which tests were held also prevented a comprehensive survey of the abilities of all the children within these schools.

Classified by school, age, sex and ethnic background, the children selected initially for inclusion in the program were as follows.

1. "Learning Games School": Experimental school in which special learning games were applied and directed toward academic operations.

	Number	Boys	Girls	Negro	Mexican-American
Grade 1	11	6	5	5	6
Grade 2	8	4	4	5	3
Grade 3	7	5	2	5	2
Grade 4	9	3	6	7	2
TOTALS	35	51.4%	48.5%	62.8%	37.1%

None of the subjects in this school dropped out during the course of the program. All engaged in all pre- and posttests.

2. "Classroom Tutoring School": Control school in which children selected engaged in special small-group tutorial sessions.

	Number	Boys	Girls	Negro	Mexican-American
Grade 1	14	9	5	10	4
Grade 2	11	7	4	11	0
Grade 3	4	2	2	4	0
Grade 4	6	4	2	6	0
TOTALS	35	62.8%	37.1%	88.5%	11.4%

One boy (Mexican-American) and 2 girls (Negro) in Grade 1 dropped out of school during the course of the program. Thus data on 32 children was subjected to pre - posttest comparisons in this second group.

3. "Physical Education School": Control school in which special periods of physical education were given the children.

	Number	Boys	Girls	Negro	Mexican-American
Grade 1	11	6	5	6	5
Grade 2	8	4	4	7	1
Grade 3	8	4	4	7	1
Grade 4	8	4	4	3	5
TOTALS	35	51.4%	48.5%	65.7%	34.2%

Two boys (Mexican-American), 1 girl (Negro) in grade 1, 1 girl (Mexican-American) in grade 2, 1 girl (Mexican-American) and 1 boy (Negro) in grade 4 dropped out of school during the course of the study. Thus a total of 29 children completed the investigation in this group.

4. "True Controls": School in which no special tutorial help nor any physical education program was administered between pre- and posttests.

	Number	Boys	Girls	Negro	Mexican-American
Grade 1	12	6	6	10	2
Grade 2	9	5	4	7	2
Grade 3	8	3	5	4	4
Grade 4	6	3	3	5	1
TOTALS	35	48.5%	51.4%	74.2%	25.7%

Two boys (Negro) in grade 1, 1 boy and 1 girl (both Negro) dropped out of the school during the course of the study. Thus 32 children's scores were subjected to the final data analysis.

From a total of 140 subjects selected for inclusion in the program from the four schools, 127 remained the entire semester. The percentage breakdown of this total of 127 subjects is as follows:

53.5% were boys; and 46.4% were girls.
74.0% were Negro; and 25.9% were Mexican-American
31.4% of the subjects were in Grade 1
25.9% of the subjects were in Grade 2
21.2% of the subjects were in Grade 3
21.2% of the subjects were in Grade 4

While it was initially intended to utilize an I.Q. test (Lorge-Thorndike) to select the subjects upon inspection of the students' files it was found that this test was administered only to the children in the fourth grades. It was for this reason that the other tests mentioned were employed (Iowa Test of Basic Skills, the Stanford Achievement Test and the Metropolitan Readiness Test - Grade I).

TESTING BATTERY EMPLOYED

During the first two weeks of the program the children in the four groups (schools) were tested. The test battery formulated took about one hour to administer to each child. Several of the tests had been previously standardized, while others had been used in the pilot study to this investigation, and their reliability established via test, retest correlations.

The testing team composed of five members traveled from school to school during this period of time and stayed at one school for two days in order to complete the testing of 35 children at each school.[1]

The children were tested individually, and the testing stations were placed in cubicles in a large utility room so that a minimum of distraction was experienced by them.

TEST BATTERY

The initial battery of tests was composed of 8 major divisions, in which a total of 14 sub-tests was contained.

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[1] The testing team was trained in the administration of the test battery for a period of one week. During this time the testers were introduced to administration and scoring techniques, and they practiced administering the tests on a population of 12 children who were not directly involved in the investigation at a school also not taking part in the program.

The detailed description of these tests is found in the Appendix. In summary, however, they consisted of the following:

1. Body Perception: 1 score derived from how well children could verbally identify body parts and the left-right dimensions of their bodies when asked to do so. (Test Re-test Reliability = .82)

2. Gross Motor Ability: 3 sub-tests consisting of

   A. Gross Agility: score derived from two tests ascertaining how well children can move in a vertical plane (i.e., getting up and down on a mat). (Reliability r = .82)

   B. Balance: a measure of static balance, in which progressively harder sub-tasks are administered to obtain the final score. (Reliability r = .80)

   C. Locomotor Agility: score obtained by observing how well children could move horizontally via hopping, jumping and the like. (Reliability r = .84)

3. Self Control: One score obtained by timing a child to the nearest 10th of a second, concerning how fast he walked a line on the ground 1' wide and 12' long, when asked to do so as "slowly as you can." (Reliability r = .81)

4. Pattern Recognition: 2 sub-tests consisting of:

A. Visual Matching: from among 6 choices children were scored according to how well they could point to a "match" to common geometric figures presented by the tester one at a time. (Reliability r = .90)

B. Verbal Identification: children were asked to name common geometric figures when presented one at a time. (Circle, triangle, rectangle, square, diamond, half-circle). (Reliability r = .94)

5. Letter Recognition: 3 sub-tests consisting of:

A. Verbal Identification: of upper case letters, randomly presented, and then removed prior to eliciting child's response. (Reliability r = .98)

B. Verbal and Written Identification: children observed in random fashion (lower case letters) and then were required to name them after model had been removed from view. (Reliability r = .96)

C. Sequential Verbal Identification of Letters: Children were asked to name in alphabetical order upper case letters contained on cards randomly distributed on a table and all remaining in view throughout the test. Score was number of letters correctly identified in order. (Reliability r = .93)

6. Serial Memory: 3 sub-tests.

A. Auditory Memory of Digits: Sets of 3 to 8 one-digit numbers were given orally and child had to repeat the numbers in order. Total possible score was 8, and the child was given two missed sets before test was discontinued. (Reliability r = .90)

B. Visual Memory of Letters: Sets of letters, 3 to 8 in a set, were presented, and after each presentation the child had to repeat the letters (upper case) in the correct order. Scoring was the same as in Test A, in this category. (Reliability r = .79)

C. Memory of Gross Movement: Testers performed from 3 to 8 movements of the total body, in up to 4 configurations. Child's score was obtained from the largest set of movements he could remember. He was allowed to miss two sets before terminating the test. (Reliability r = .84)

7. Spelling: Twenty words of increasing difficulty, from 1st through 4th grade word lists (from Dolch Basic Word List), were given orally, and the children were required to write them. The word list arrived at was first inspected by all classroom teachers whose children were involved in the program in order to ascertain its appropriateness. (Reliability r = .96)

8. Peabody Picture Vocabulary Test:

The PPVT is an untimed individual test, administered in 15 minutes or less, consisting of 3 practice and 150 test plates. It has moderate reliability and largely unestablished validity, however. Moderate correlations have been obtained between the scores on the Peabody and the California Test of Mental Maturity and the Henmon-Nelson Tests of Mental Ability. It is largely a measure of verbal intelligence and is similar to parallel measures of adult intelligence. Reviewers of this test have suggested that it is the "best of its kind:" however, warn that interpretation of its results after testing any but the population upon which it was standardized (over 4,000 white children near Nashville, Tenn.) should be carried out cautiously.

Trend Tests

Twice during the semester, on Tuesdays and Thursdays during which the regular program was not operative, the testers sampled the behavior of the children involved in the study on seven sub tests including: 1. Body Perception, 3. Self-Control, 4B. Verbal Identification of Geometric Figures, 5ABC. All tests of Letter Recognition, 6B. Visual Memory of Letters.

The results of these tests are summarized in the chapter which follows, and the significant trends in group and individual progress which they reflect provided information important in the evaluation of the program.

TEACHING METHODS AND PROCEDURES

Overview

In all schools in which special programs were being held the teachers worked with small groups of children, from three to eight in a group, three times a week (Monday, Wednesday and Friday mornings). Each class lasted 30 minutes, and thus a total of one and one-half hours of special attention each week in the form of learning games, special classroom tutoring, or physical education was received by each of the children in the three groups.[2]

It was planned to regularly rotate the teachers among the schools every six weeks, in an attempt to control for the effects of the instructor's unique personal and professional characteristics upon the children evaluated. At the two schools in which special instruction in academic skills was being undertaken (classroom tutoring and learning games), the teachers attached to this program attended the children's regular classes and observed the total program, and additionally met at least once every two weeks with the teachers of the children with whom they were dealing. In this way it was hoped to keep the activities within these two groups as congruent as possible within the total academic program to which the participating children were exposed.

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[2] Essentially, therefore, the investigation deals with the manner in which special attention, approximating from 5 to 10% of the total time the children spent in schools, influenced their academic performance.

Overall, the children received 18 weeks of instruction. The ten trend tests given twice during this period of time were administered on Tuesdays and Thursdays so as not to interfere with the instructional program. The time taken for the pre- and post testing periods, lasting two weeks each, was not deducted from the 18-week instructional period.

As is true in most investigations of this nature, a variety of problems emerged. For example, shortly after the pre-tests, the Archdiocese announced that all nine of the second grade children assigned to the study, within the control group who were purportedly to receive no special attention, would receive special classroom tutoring lasting for the duration of our study, and to take place five times a week. A decision was made by the administrators of this program to retain these children in the study, due to the pressure of time. At the same time, the scores of these children have been subjected to separate analyses when appropriate, in the chapter which follows.

Due to poor health, two of the teachers trained for the project had to terminate their employment mid-way in the program. The necessity of training additional personnel suddenly presented itself and prevented the orderly rotation of personnel between the schools every six weeks, as was planned initially.

Physical Education Group

The children within the physical education group were exposed to a structured program of physical activities including those intended to improve specific sports skills: throwing, kicking, and the like, as well as games appropriate to children from the 1st to the 4th grades. The program lasted 18 weeks and was carried out three times per week in one-half hour classes. The instructor, having a B.S. degree in physical education taught four classes each of the mornings she visited the school.

These children were given the pre- and posttest batteries and as was the case with the other groups, received the two "trend" test batteries at the same time as did the other groups, at six weeks and twelve weeks.

The physical education program varied according to the age levels of the children; the younger children in the first and second grades were exposed to games involving simple organization, and at the same time had tumbling once a week on mats provided for the purpose. The older children in the 3rd and 4th grades were introduced to games of a more complex nature, and including modifications of volleyball, kickball and the like.

Classroom Tutoring Group

The program for the children receiving special small-group classroom tutoring was carried out in a special classroom set aside for that specific purpose. As in the other groups, four classes per morning were taught containing from 5 to 8 children each. Each class lasted 30 minutes, and was given Monday, Wednesday and Friday for 18 weeks.

Practice was given in letter recognition, spelling, pattern recognition and similar classroom skills and employing the usual methods. Children were often permitted to move around the room and to work on blackboards when this was appropriate. Practice in writing and printing letters and words was frequently engaged in (the 1st and 2nd grade children printed, while the 3rd and 4th graders engaged in cursive writing).

The materials from the Open Court Program of Phonics Instruction were utilized by the teachers engaged in this program. Movable Alphabets, and similar educational aids were used frequently. Additionally the teachers constructed their own "flash cards" when they were deemed helpful. In every way it was attempted, while remaining congruent to what was happening in the regular classroom, to teach the academic operations inherent in the learning games engaged in by the other group (school) in the program. Thus practice in pattern recognition, letter recognition, (upper and lower case) as well as spelling games were engaged in. Impulse control activities including practice in moving slowly, relaxation training, etc. were not engaged in.[3]

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[3] These latter activities are not usually found to occur in the traditional elementary-school classroom.

The teachers selected for this group were the most experienced ones available to the project's administrators. Observations of the teachers' performances confirmed that they took special pains to provide highly motivating experiences for the children.

Learning Games Group

A number of publications have been published containing the rationale underlying the learning games as well as their specifics. The teachers engaged in this phase of the program spent a considerable amount of time reviewing this literature (20)(19)(23). In essence,however, they were directed to shape their program toward what they felt to be the perceived needs of the children confronting them.

In general, the three-day-a-week, one-half hour classes contained a variety of activities. The younger children, and the older children during the early weeks of the program engaged in relaxation training and impulse control activities during the initial parts of the class period. As it was seen that the children became able to follow directions more latitude was given and they were permitted to make more choices concerning the nature of the activities they participated in.

The children in the first two grades initially worked hard on pattern and letter recognition games. This emphasis lasted through most of the first half of the 18-week program.

They also played games involving serial memory ability, and performed in a variety of ways activities in sequence which their classmates observed, and attempted to imitate. These latter activities were found to be highly motivating and often were used as rewards for successful participation in other parts of the program.

During the 18-week period a variety of types of movable letters were experimented with in addition to the letter grids outlined in the previous chapter (II). It was felt that if the letter squares were movable a greater variety of games might be employed, and at the same time it was less likely that children would depend upon place cues in the identification of letters as might occur if a painted and fixed grid of letters was employed. (i.e. "the A is the letter in the upper left-hand corner of the grid").

These movable letters took several forms. Initially masonite squares were cut containing letters and these were encased in metal frames to prevent them from sliding on the floor when jumped on. These frames would contain 9 to 36 letter squares (1' x 1' each). However this proved unsatisfactory as the frames were unstable and jumping resulted in a "clatter" as their feet struck the squares. Subsequently, rubber squares from carpet undermatting material were cut and letters were stenciled on them. These proved more satisfactory in so far as they adhered to the floor and they were safer. They also lent themselves to various relays in which the children carried the various letters from place to place.[4]

The sets of masonite squares and the rubberized squares were made to contain both upper and lower case printed letters, as well as squares containing script (written) letters. These latter letters were employed in an effort to achieve transfer between letter shapes, i.e. and "a" is the same as an "A" is the same as an "a". In addition, these script letters were employed in games to which the children in the 3rd and 4th grades were introduced. Within these latter two grades, the children were introduced by their regular classroom teacher to cursive writing and thus to the recognition of handwritten letters and words.

Analysis of Data

Using an Olivetti Programma 101, one-way analyses of variances were computed between the group differences evidenced by test, which were obtained by subtracting the pre-test scores from the post test scores, and from the two sets of scores obtained on each of the two trend test batteries administered.

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[4] The authors are aware of two commercially-produced sets of movable letters suitable for the various learning games employed. (a) The Instructor Company, Paoli, Pennsylvania, 19301, produces upper and lower case letters in sets of rubberized squares 6" by 6". (b) Action Learning Inc., P.O. Box 49672, Los Angeles, California, 90049, produces sets of larger squares, 10" by 10", containing numbers, letters, geometric figures, with figures on both sides of the squares.

Additionally, t scores were compared to delineate specific differences within and between groups in the various tests given. The scores of various sub-groups were also analyzed. Comparisons of improvement by sex and grade, were also carried out.

Moreover a case study approach was taken to some of the data to determine how the children evidencing the poorest achievement in selected tests fared during the semester. The progress of the ten children evidencing lowest achievement in each group, those within the lowest 3 in each test by group, as well as the single poorest achiever in each group were scrutinized in this manner.

SUMMARY

One hundred twenty-seven children from four schools were selected for inclusion in the Program. The children in grades 1 through 4 were taken from among those whose scores on standardized tests of academic achievement and classroom potential indicated that they fell significantly below their grade level. A pretest of 14 sub-tests was administered prior to the beginning of the 18-week semester. During the semester two shortened trend tests of 10 items each were given 6 weeks apart, and finally the posttest battery was repeated at the completion of the instructional program. The tests were administered individually.

The children within four groups (schools)were either exposed to no special activities other than the testing program; a special three-day-a-week physical education program lasting one-half hour a day; a special small-group classroom tutoring program; or a lesson of learning games also administered three times a week in one-half hour sessions in the mornings.

The data was analyzed by comparing pre- to post test means and via one-way analyses of variance tests to determine inter-and intra-group variances based upon pre- and post test differences. The scores of various sub groups were also analyzed by sex and by grade. Additionally, a case-study approach was taken with the data to determine how the children scoring lowest within each of the categories fared within the experimental (learning games) group and the various control groups.

CHAPTER IV

FINDINGS

The findings derived from the primary portion of the investigation have been divided into several sections. Initially the results of the pre-testing program are examined; the means and standard deviations by test, grade, and school are presented together with a factor analysis involving all 127 children initially tested.

Next, the results of the twice-administered, 10-trend tests are presented. This shortened battery was given twice during the course of the instructional program to all four groups: one experimental and three controls. Graphs depicting the rate as well as the degree to which the children evidenced changes in the various attributes tested, are contained in this second part of the chapter. This section also contains a brief progress report on the manner in which various of the less capable children's scores appeared during this trend-testing program.

The third part of the chapter contains the results of the analyses computed to determine the significance of the amount of change evidenced by various subgroups. This analysis is carried out for selected tests. Additionally, a report on the final progress of some of the less capable children is carried out. Selected data showing the change by grade and sex are also presented in this third section of the chapter.

The final part of the chapter contains a summary of the findings. A discussion of the findings and the implications of the results are found in the chapter following this one (Chapter V).

Overall Mean Scores Obtained.

Inspection of Table I reveals that overall the 140 children identified initially for inclusion in the study had an average I.Q. of 86.96. As a group, they could verbally identify only 20 out of 26 letters of the alphabet, and were even less able to recite the alphabet in order (16 out of 26 correct). They could repeat via writing only 18 out of the 26 letters of the alphabet after first viewing each one in order. They could identify verbally only about 3 (Mean 2.7) out of 6 common geometric figures shown to them, and the second, third and fourth graders tested could spell only about 7 (Mean 7.4) out of 20 spelling words given them verbally. Their memory span was about 5 items; while their self-control was considerably below what could be expected in a group of children with an average age of about 7.5 years when asked to walk a 12' line "as slowly as you can," i.e. 16 seconds as contrasted to a mean score of 38 seconds obtained from a group of white children with a mean age of 6 years in a recent study!

The scores in balance tests and tests of ability (hopping and jumping in squares, and arising from a backlying position) were about what would be expected for children of this age, while their scores in a test of body perception (verbal identification of body parts and their left-right dimensions), was slightly below average for a population of children of this age.

TABLE I

MEAN SCORES, BY TEST, FOR TOTAL SUBJECTS IN PRETEST (N=132)

TEST	MEAN	STANDARD DEVIATION
1. I.Q. (PPVT)	85.96	18.84
2. Body Perception	6.36	2.57
3. Gross Agility	6.45	2.13
4. Balance	6.36	2.06
5. Locomotor Agility	6.47	1.45
6. Persistence	16.38	7.29
7. Pattern Recognition (visual)	5.86	.38
8. Pattern Recognition (verbal)	2.77	1.32
9. Letter Recognition (verbal)	20.10	8.20
10. Letter Recognition (written)	18.96	8.53
11. Letter Recognition (sequence)	16.42	10.28
12. Serial Memory (auditory)	5.12	1.56
13. Serial Memory (visual)	4.14	2.46
14. Serial Memory (auditory visual)	6.16	1.63
15. Spelling	7.43	5.99

SURVEY OF MEAN SCORES OBTAINED IN PRE-TESTS

Initial Group Means:

As can be seen in Tables II, III, IV, and V, containing the mean scores for the various groups, the I.Q. scores obtained indicated that, as a group, the children were generally in the dull to normal category (range from 80.1 to 92.57). It is probable, however, that the I.Q. scores obtained were more a reflection of some kind of incongruence between the measures used and the cultural setting in which the children were raised. For example a "correct" response on the Peabody Picture Test of I.Q. employed, for a picture of a hot dog, was "weiner", a term not frequently used by middle-class, white children, and never employed by Black and Mexican-American children in the central city.

In general, the children initially could not distinguish the left-right dimensions of their body as indicated by mean scores ranging from 5.72 to 6.52 out of a possible 10 points in three of the four groups surveyed. The highest initial mean of 7.37 out of a possible 10 points was obtained from the children in the experimental Learning Games Group.

Their balance and agility scores were about what would be expected of children of this age (mean 7.54 years), while their total battery score combining the various motor tests (balance, agility and body perception), ranged from 18.83 points to 20.62 points out of a possible 30 points. Again, the mean obtained from the children in this study of these three tests combined, was about what would be expected from children of this mean chronological age.

A most interesting and significant score obtained initially from the four groups,was that recorded when they were asked to walk a 12' line "as slowly as they could," purportedly a measure of persistence and self-control.[1] The initial group means of these children with an average of about seven and one-half years, was from 14 to 19 seconds. Whereas in a recent unpublished study carried out in a predominantly white elementary school on the University Campus (UCLA), the mean score for 6 year olds (N=40), was 38 seconds for this same task[2]

The mean scores obtained when the children were asked to visually match six geometric patterns, i.e. point to matches, revealed that they were reasonably proficient at this type of task. (Scores ranging from 5.8 to 5.9 out of a possible 6). On the other hand, when the children were asked to attach verbal labels to the triangles, circles,squares, etc. shown to them, they exhibited less proficiency, with mean scores ranging from 2.48 to 3 correct out of a possible 6. It was thus apparent that the children initially could visually perceive the geometric patterns, but their ability to name and compare these same figures was not as correctly.

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[1] Such a measure may of course, also be a reflection of conformity to experimenter directions, or of a number of other personal attributes including the ability to translate a time concept (slowly) into a concrete action pattern.

[2] In this small study, the white children were found to be significantly faster (twice as fast) as the black children tested. A comparison of the scores of 13 children of each race was carried out. (Burke, Karen, "A Survey of Selected Self-Control Measures in Elementary School Children", Unpublished Study, Perceptual-Motor Learning Laboratory, UCLA, 1970.)

The initial letter recognition scores indicated that many of the children were reasonably proficient at verbally identifying the letters of the alphabet with the mean scores ranging from 17 to 23 (out of 26). At the same time, it must be remembered that the population of children upon which these means were obtained ranges to the fourth grade, and also the often overlooked fact that one-half of the children who contribute to any mean, score below that mean! Thus it is obvious that many more of the children included did not know all the letters of the alphabet, a deficiency which has been shown to correlate significantly to reading success (5).

Closer inspection of the mean score reflecting letter recognition reveals that the ability to verbally identify a letter, and to say the letters and to write them when presented in random order,seem about equal. At the same time, the score obtained when the children were asked to repeat the alphabet in correct order did not result in mean scores which were as high (range 13 to 20 letters out of 26).

The scores on serial memory ability revealed that the children as a whole, were better able to repeat a series of letters verbally, 5 remembered out of a final list of 8, than they were to visually arrange items to be remembered.

The pre-test spelling scores were obtained only from the children in grades 2,3, and 4. Twenty words commonly found in spelling lists in these grades were given. The scores reveal that the children dealt with in this experimental program were not very proficient spellers, as only one group mean reflects a score as high as 10, while the others range from 6 to 7.6 out of a possible 20 correct.

As can also be seen upon comparing the mean scores of the various groups employed in this program, they evidenced different initial capacities. The "Learning Games Group", for example, exhibited better ability to recognize letters of the alphabet on the initial testing (23 out of 26) than did all the other groups (from 17 to 21 out of 26). The mean I.Q.'s of two of the groups similarly evidenced differences, with two of the groups averaging 90, while two other groups averaged about 80. These differences are partly accounted for in the analyses of variance presented later in this chapter, page , as they are based upon intra-group differences in pre-test and post test means. Considerations of time, facilities, and expediency dictated the keeping of a similar type of experimental or control group within a single school. Attempting to carry out more than one type of program within a single school could have, of course, resulted in initial group means which might have been more similar to each other.

TABLE II

MEAN SCORES BY LEARNING GAMES GROUP IN PRE-TESTS AND POST TESTS, AND COMPARISON OF DIFFERENCES VIA t TEST (N=35)

TEST	PRE-TEST		POST TEST			
	Mean	S.D.	Mean	S.D.	t	Significance
1. I.Q.	92.57	14.14	89.86	11.33	1.86	5%
2. Body Perception	7.37	2.30	8.69	1.53	4.96	1%
3. Agility	6.31	1.86	7.89	1.26	7.31	1%
4. Balance	6.63	2.06	7.43	1.52	3.42	1%
5. Locomotor Agility	5.89	1.01	7.29	1.74	6.76	1%
6. Persistance	14.71	5.59	42.49	5.33	41.71	1%
7. Pattern Recognition (Visual)	5.91	0.29	6.00	0.00	2.04	5%
8. Pattern Recognition (Verbal)	3.09	1.08	5.09	1.03	14.92	1%
9. Letter Recognition (Verbal)	23.06	5.28	25.77	0.65	24.77	1%
10. Letter Recognition (Written)	22.34	5.49	25.83	0.41	3.90	1%
11. Letter Recognition (Sequence)	20.86	7.16	25.49	1.78	4.54	1%
12. Serial Memory (Auditory)	5.00	1.64	5.89	1.74	4.26	1%
13. Serial Memory (Visual)	4.57	2.21	6.11	1.85	5.35	1%
14. Serial Memory (Motor Visual)	6.26	1.59	6.69	1.82	2.01	5%
15. Spelling	10.76	6.19	13.63	4.96	4.06	1%

TABLE III

MEAN SCORES BY CLASSROOM TUTORING GROUP, IN PRE-TESTS AND POST TESTS, AND COMPARISON OF DIFFERENCES VIA t TEST (N=32)

TEST	PRE-TEST		POST TEST		t	Significance
	Mean	S.D.	Mean	S.D.		
1. I.Q.	90.03	18.78	89.38	20.37	.333	N/S
2. Body Perception	5.72	2.38	7.41	1.97	5.91	1%
3. Gross Agility	6.09	2.33	7.37	1.87	4.59	1%
4. Balance	6.16	1.79	6.44	1.56	1.26	N/S
5. Locomotor Agility	6.16	1.50	7.03	1.59	4.42	1%
6. Persistance	14.78	6.19	25.69	17.88	4.38	1%
7. Pattern Recognition (Visual)	5.81	0.47	5.97	0.20	2.07	1%
8. Pattern Recognition (Verbal)	3.00	1.20	5.38	0.86	16.53	1%
9. Letter Recognition (Verbal)	19.44	8.10	25.53	0.87	4.53	1%
10. Letter Recognition (Written)	17.69	8.38	25.06	1.28	5.49	1%
11. Letter Recognition (Sequence)	16.25	10.80	22.16	4.86	4.19	1%
12. Serial Memory (Auditory)	5.47	1.12	5.09	1.93	.12	N/S
13. Serial Memory (Visual)	4.25	2.36	5.06	2.66	.15	N/S
14. Serial Memory (Motor Visual)	5.66	1.88	5.59	2.65	.22	N/S
15. Spelling	6.06	4.92	9.72	4.94	5.83	1%

TABLE IV

MEAN SCORES BY PHYSICAL EDUCATION GROUP, IN PRE-TESTS AND POST TESTS, AND COMPARISON OF DIFFERENCES BY t TEST

(N=29)

TEST	PRE-TESTS		POST TESTS		t	Signif-icance
	Mean	S.D.	Mean	S.D.		
1. I.Q.	80.10	21.54	80.52	17.74	.15	N/S
2. Body Perception	6.52	2.46	7.93	1.96	4.53	1%
3. Gross Agility	7.28	2.31	7.93	1.78	.12	N/S
4. Balance	6.17	1.93	7.31	1.26	4.67	1%
5. Locomotor Agility	7.31	1.51	8.72	1.48	7.05	1%
6. Persistance	18.28	8.13	41.31	22.70	6.97	1%
7. Pattern Recognition (Visual)	5.83	0.39	6.00	0.00	2.42	1%
8. Pattern Recognition (Verbal)	2.48	1.52	3.28	1.53	3.86	1%
9. Letter Recognition (Verbal)	17.83	9.17	22.90	5.66	4.33	1%
10. Letter Recognition (Written)	17.24	9.62	22.55	6.81	4.40	1%
11. Letter Recognition (Sequence)	13.10	11.10	20.86	7.24	5.53	1%
12. Serial Memory (Auditory)	5.03	1.50	5.38	2.22	1.24	N/S
13. Serial Memory (Visual)	3.79	2.70	5.11	2.56	3.71	1%
14. Serial Memory (Motor Visual)	6.69	1.40	6.03	2.39	2.13	5%
15. Spelling	7.21	5.56	9.69	6.78	3.22	1%

TABLE V

MEAN SCORES BY "NO ACTIVITY" CONTROL GROUP, IN PRE-TESTS AND POST TESTS, AND COMPARISON OF DIFFERENCES BY t TEST

(N=31)

TEST	PRE-TESTS		POST TESTS		t	Significance
1.I.Q.	81.23	17.49	82.68	15.45	.67	N/S
2.Body Perception	6.03	2.53	7.22	2.78		
3.Gross Agility	6.68	1.93	7.74	1.30	3.43	1%
4.Balance	6.35	2.20	7.61	1.32	4.63	1%
5.Locomotor Agility	6.81	1.23	7.61	1.58	4.12	1%
6.Persistance	19.16	8.61	23.39	12.01	2.91	1%
7.Pattern Recognition (Visual)	5.97	0.20	5.97	0.20	0.00	N/S
8.Pattern Recognition (Verbal)	2.48	1.46	3.22	1.26	4.16	1%
9.Letter Recognition (Verbal)	21.23	7.59	25.48	1.00	3.39	1%
10.Letter Recognition (Written)	20.26	8.18	24.94	1.42	.84	N/S
11.Letter Recognition (Sequence)	17.48	9.21	23.06	5.84	.34	N/S
12.Serial Memory (Auditory)	5.16	1.35	5.74	2.07	2.26	5%
13.Serial Memory (Visual)	4.13	2.00	5.90	2,61	5.58	1%
14.Serial Memory (Motor Visual)	6.26	1.39	6.13	2.17	.48	1%
15.Spelling	7.65	5.72	10.52	5.65	3.93	1%

Inter-Group Comparisons of Mean Scores Obtained From Pre- and Post Program-Testing Programs.

The data contained on Tables II through V permits several interesting comparisons to be made between the various group means obtained prior to and at the completion of the study, in the various tests to which the children were exposed. Not all of these have been examined in the paragraphs which follow; however, it is believed that the ones selected, provide meaningful insights into the problem evaluated.[1]

For example, the pre-test means in the measure of self-control used (slow line walking), were similar in the Learning Games Group and in the Classroom Tutoring Group (14.71 and 14.78 seconds), their final mean scores were highly dissimilar. The final mean score for the children in the Learning Games Group, exposed to relaxation training and to the impulse control activities, was only 25.69 seconds (S.D. = 17.88). The value computed between these final means was 5.03, significant at the 1% level of confidence. It is interesting to note also the difference in the two standard deviations on the part of these two groups. The significantly larger "spread" on the part of the Classroom Tutoring Group indicates that within that group, there were a number of children who remained highly active and not prone to exhibit much self-control when asked to move as "slowly as you can".

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[1] Most of the following comparisons involve contrasting the Learning Games Group with the pre-test and post test scores obtained from the Classroom Tutoring Group. Eight children of the 2nd grade in the so-called "No Activity" Control Group were unexpectedly given 5-day-a-week tutoring shortly after this study was instituted.

The data on Tables II through V also indicates that the children exposed to classroom tutoring and to the learning games, evidenced highly similar improvement and final scores on the two measures of pattern recognition and in two out of three of the measures of letter recognition employed. However, the children in the Learning Games Group performed better when asked to recite the alphabet in order, than did the children in the Classroom Tutoring Group (respective means were 22.16 letters, S.D. 4.86, and 25.49 letters, S.D. = 1.78 out of 26 for the two groups). The t computed between these two final levels of achievement indicated a difference significant at the 1% level in favor of the children exposed to the learning games (t = 3.55).

In all three measures of serial memory, the children given learning games scored significantly higher than did the children given special classroom tutoring; this despite the fact that only one of these scores was based upon the type of task directly inserted into the educational regime of the children who received special help in a more active manner. All of the final differences in the mean scores between the Learning Games and the Classroom Tutoring Groups, were significant at the 5% level, and in favor of the child in the Learning Games Group. The t scores were 1.76 for auditory serial memory, 1.83 for visual serial memory and 1.93 when the final means obtained from the task involving the duplication of another child's movements in total body movement tasks, were compared.

Further analysis of the data obtained from the three serial memory tasks indicates that all scores reflected significant change when the pre-test and post test comparisons were made within the Learning Games Group. When the same three comparisons were made within the Classroom Tutoring Group, no significant changes took place.

The Learning Games Group evidenced significantly superior performance in their final spelling test, when contrasted to the scores of the children who were given special small-group classroom tutoring.[2] The spelling test, consisting of 20 words, was given initially and at the completion of the program and was not placed in the two trend tests, nor were the specific words on the list, compiled after consulting a number of spelling lists for children in the 2nd, 3rd, and 4th grades. The Classroom Tutoring Group was able, on the average, to spell 9.72 (S.D.=4.94) words out of the 20 word list at the completion of the semester's program; while the children in the Learning Games Group, registered a significantly higher score of 13.63 words (S.D.=4.96). The t value for this comparison was 3.18(significant at the 1% level of confidence)

Correlation of Initial Scores and a Factor Analysis.

The scores obtained from the 128 subjects tested initially were inter-correlated and a factor analysis was carried out using the varifax rotation method. Eighteen variables were factor analyzed and age was factored out.

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[2] First grade children were not given this spelling test during either the pre- or the post test period.

The correlation matrix is found on Table VI. A cursory inspection (observation analysis)of this matrix reveals that moderate significant positive correlations of the order of .4 between I.Q. and verbal identification of letters and patterns probably indicates a common verbal ability needed to accomplish all three types of tests. Serial memory scores, the ability to recite the alphabet in order and to recognize letters of the alphabet, also disclose factors of auditory and visual memory probably common to these kinds of tasks.

Moderate positive and significant correlations between the measure of self-control in the battery (slow line walking) and spelling, .42, and the ability to write letters of the alphabet after seeing them one at a time, .33, probably indicate that attention and self-control are qualities common to these two tasks.

Common skills are also likely in the tests involving letter recognition, and serial memory ability and spelling, judging from the moderate to high correlations obtained when spelling scores were contrasted to those of the former two types, (range from .30 to .74).

Factor Analysis.

In an effort to isolate factors common to groups of the tasks in a more exact manner, a factor analysis was employed. Using the varifax rotation method, three factors emerged as seen on Table VII. Only factor loadings exceeding .30 are listed on Table VII.

Factor I was named "Perception and Identification of Symbols" due to the loadings of the three-letter recognition and spelling scores. The factor is also contributed to by the scores from the serial memory tasks, and from the pattern recognition score in which a verbal identification of patterns was required. Interesting also is the fact that the "body perception" score loaded .52 on this factor, indicating that successful performance in this type of test is probably more dependent upon a child's vocabulary and verbal ability than a true test of the perception of his body; or perhaps that the body parts are in some way similar to the maturing child as are other symbols, i.e. letters and patterns external to his body. It is also believed noteworthy that the score in persistence, i.e. a measure of self-control in line walking, contributed to a moderate degree (.38) to the total factor, in which the majority of scores were of a perceptual and/or a cognitive nature.

Factor II was named "Gross-Motor Ability", and contained, as can be seen on Table VII, scores from the two agility tests and the balance test. Contributing also to this factor are the scores from the measure of body perception used in the study (verbal identification of body parts), and from the measure of self-control (persistence) involving slow line walking. It is believed important to point out that whatever is evaluated when asking a child to identify his body parts and to walk a line as slowly as he can, correlates lower with

TABLE VI
CORRELATION COEFFICIENTS OF PRE-TEST SCORES FOR ALL SUBJECTS (N=140)

1.I.Q.	1.00														
2.Body Perception	.26	1.00													
3.Gross Agility	14	.43	1.00												
4.Balance	.13	.01	.28	1.00											
5.Locomotor Agility	.10	.09	.21	.22	1.00										
6.Persistance	-.01	.29	.28	.23	.25	1.00									
7.Pattern Recognition (Visual)	.00	.14	.09	.17	.06	.06	1.00								
8.Pattern Recognition (Verbal)	.42	.25	.02	.04	-.20	.09	.02	1.00							
9.Letter Recognition (Verbal)	.40	.43	.14	.28	.06	.31	.24	.37	1.00						
10.Letter Recognition (Written)	.37	.49	.19	.30	.11	.33	.24	.35	.95	1.00					
11.Letter Recognition (Sequence)	.34	.54	.24	.22	.11	.28	.22	.29	.80	.84	1.00				
12.Serial Memory (Auditory)	.26	.34	.13	.15	.12	.15	.20	.30	.35	.40	.39	1.00			
13.Serial Memory (Visual)	.30	.45	.20	.27	.10	.24	.14	.25	.69	.71	.66	.41	1.00		
14.Serial Memory (Auditory-Visual)	-.09	.29	.26	.03	.14	.30	.09	.01	.15	.22	.25	.18	.24	1.00	
15.Spelling	.22	.56	.24	.28	.11	.42	.21	.30	.66	.73	.74	.30	.57	.43	1.00

this "movement" factor (.36 and .30 respectively), than with the previous "academic" factor (.52 and .38 respectively).

The third factor was not clearly delineated, and contained two scores: one from the Peabody Picture Test of I.Q., and a second score (loading .39) from the test involving the verbal identification of six common geometric figures. In previous data collected in this project, it was found that there was a high correlation between the Lorge Thorndike of I.Q. and the Peabody (.75), with these same two scores evidencing no significant positive correlations with any of the academic and pre-academic scores obtained.

Inter-Group Improvement Scores, by Test, Surveyed via One-Way Analyses of Variance

Inspection of the data from Table VIII indicates that overall, only in the test involving verbal recognition of geometric patterns and in the test assessing the ability to recall numbers presented verbally, are there significant differences in the improvement scores (pre-test scores subtracted from the post test scores) between the groups. Thus it appears that by the end of the semester, the improvement within and between the various groups was highly similar in 12 out of the 14 measures obtained. At the same time, Tables IX and X, which follow and reflect improvement at various points within the semester, are more revealing of how rapidly some of the basic concepts and academic operations contained in the various trend tests given twice during the semester were acquired by the children participating in the various groups and sub groups.

TABLE VII

FACTOR ANALYSIS OF PRE-TEST SCORES

THE VARIFAX FACTOR MATRIX FOR 15 VARIABLES
(N=140)

FACTOR I: Memory and Perception of Symbols

.91	Written Letter Recognition
.88	Verbal Letter Recognition
.83	Letter Recognition in Sequence
.81	Spelling
.69	Visual Serial Memory
.52	Body Perception
.41	Auditory Serial Memory
.38	Persistence, Line Walking
.36	Auditory-Visual Serial Memory
.33	Verbal Pattern Recognition

FACTOR II: Gross Motor Ability

.71	Gross Agility
.64	Balance
.63	Locomotor Agility
.36	Body Perception
.30	Persistence

FACTOR III: I.Q.

.93	I.Q.
.39	Verbal Pattern Recognition

TABLE VIII

ONE WAY ANALYSES OF VARIANCE COMPARING, BY TEST, IMPROVEMENT BETWEEN PRE- AND POST TEST SCORES OF TOTAL SUBJECTS, ALL FOUR GROUPS

F SCORE FOR I.Q.

Source	SS	Df	MS	F	Sig
Between Group Variance	173.38	3	86.69	1.104	N/S
Within Group Variance	6752.26	123	78.51		
Totals	6925.64	126			

F SCORE FOR BODY PERCEPTION

Source	SS	Df	MS	F	Sig
Between Group Variance	4.71	3	2.36	.327	N/S
Within Group Variance	641.01	123	7.20		
Totals	645.73	126			

F SCORE FOR GROSS MOTOR TOTAL

Source	SS	Df	MS	F	Sig
Between Group Variance	5.75	3	2.87	.131	N/S
Within Group Variance	1947.16	123	21.88		
Totals	1952.91	126			

(Table VIII, cont.)

F SCORE FOR GROSS AGILITY

Source	SS	Df	MS	F	Sig
Between Group Variance	2.92	3	1 46	.279	N/S
Within Group Variance	465.33	123	5.23		
Totals	468.25	126			

F SCORE FOR BALANCE

Source	SS	Df	MS	F	Sig
Between Group Variance	4.96	3	2.23	.566	N/S
Within Group Variance	350.28	123	3.94		
Totals	354.74	126			

F SCORE FOR LOCOMOTOR AGILITY

Source	SS	Df	MS	F	Sig
Between Group Variance	5.94	3	2.97	.878	N/S
Within Group Variance	300.97	123	3.38		
Totals	306.91	126			

(Table VIII, cont.)

F SCORE FOR PATTERN RECOGNITION (VISUAL)

Source	SS	Df	MS	F	Sig
Between Group Variance	.411	3	.205	1.120	N/S
Within Group Variance	16.48	123	.183		
Totals	16.89	126			

F SCORE FOR PATTERN RECOGNITION (VERBAL)

Source	SS	Df	MS	F	Sig
Between Group Variance	42.67	3	21.33	6.06	1%
Within Group Variance	313.29	123	3.52		
Totals	355.96	126			

F SCORE FOR LETTER RECOGNITION (VERBAL)

Source	SS	Df	MS	F	Sig
Between Group Variance	54.97	3	27.49	.423	N/S
Within Group Variance	5779.88	123	64.94		
Totals	5834.86	126			

(Table VIII, cont.)

F SCORE FOR LETTER RECOGNITION (WRITTEN)

Source	SS	Df	MS	F	Sig
Between Group Variance	108.54	3	54.27	.782	N/S
Within Group Variance	6172.58	123	69.35		
Totals	6281.12	126			

F SCORE FOR LETTER RECOGNITION (SEQUENCE)

Source	SS	Df	MS	F	Sig
Between Group Variance	56.18	3	28.09	.292	N/S
Within Group Variance	8643.79	123	96.04		
Totals	8699.97	126			

F SCORE FOR SERIAL MEMORY (AUDITORY)

Source	SS	Df	MS	F	Sig
Between Group Variance	31.10	3	15.55	4.15	5%
Within Group Variance	306.90	123	3.74		
Totals	338.00	126			

(Table VIII, cont.)

F SCORE FOR SERIAL MEMORY (VISUAL)

Source	SS	Df	MS	F	Sig
Between Group Variance	6.11	3	3.06	.444	N/S
Within Group Variance	556.59	123	6.87		
Totals	562.70	126			

F SCORE FOR SERIAL MEMORY (MOTOR-VISUAL)

Source	SS	Df	MS	F	Sig
Between Group Variance	2.42	3	1.21	.400	N/S
Within Group Variance	247.77	123	3.02		
Totals	250.19	126			

F SCORE FOR SPELLING

Source	SS	Df	MS	F	Sig
Between Group Variance	25.69	3	12.84	.746	N/S
Within Group Variance	1530.79	123	17.20		
Totals	1556.48	126			

(Table VIII, cont.)

ONE WAY ANALYSES OF VARIANCE, COMPARING IMPROVEMENT BY GROUP, AND TEST FROM THE PRE-TEST SCORES TO THE FIRST TREND TEST SCORES

A. F SCORE FOR IMPROVEMENT IN SERIAL MEMORY (VERBAL-MOTOR)

	SS	Df	MS	F	Sig
Within Group Variance	4.56	3	2.28	.522	N/S
Between Group Variance	401.17	123	4.36		
Totals	405.73				

B. F SCORE FOR IMPROVEMENT IN BODY PERCEPTION

	SS	Df	MS	F	Sig
Within Group Variance	11.20	3	5.60	.711	N/S
Between Group Variance	724.13	123	7.87		
Totals	735.33				

C. F SCORE FOR IMPROVEMENT IN LETTER RECOGNITION (WRITTEN)

	SS	Df	MS	F	Sig
Within Group Variance	83.09	3	41.54	2.37	5%
Between Group Variance	1596.52	123	17.54		
Totals	1679.62				

(Table VIII, cont.)

D. F SCORE FOR IMPROVEMENT IN PERSISTENCE

	SS	Df	MS	F	Sig
Within Group Variance	919.53	3	454.76	3.61	1%
Between Group Variance	11575.76	123	127.21		
Totals	12495.29				

E. F SCORE FOR IMPROVEMENT IN PATTERN RECOGNITION (VERBAL)

	SS	Df	MS	F	Sig
Between Group Variance	16.32	3	8.16	2.75	5%
Within Group Variance	272.64	123	2.96		
Totals	288.96				

F. F SCORE FOR IMPROVEMENT IN LETTER RECOGNITION (SEQUENCE)

	SS	Df	MS	F	Sig
Between Group Variance	17.10	3	8.55	.275	N/S
Within Group Variance	2813.11	123	31.02		
Totals	2840.13				

TABLE IX

ONE WAY ANALYSES OF VARIANCE COMPARING, BY TEST, IMPROVEMENT BETWEEN PRE-TEST SCORES AND THOSE IN SECOND TREND TEST, BY GROUP, TOTAL SUBJECTS, IN SELECTED TESTS

A. F SCORE FOR IMPROVEMENT IN SERIAL MEMORY (VERBAL-MOTOR)

	SS	Df	MS	F	Sig
Between Group Variance	4.19	3	2.09	.305	N/S
Within Group Variance	604.76	123	6.87		
Totals	608.96				

B. F SCORE FOR IMPROVEMENT IN LETTER RECOGNITION (SEQUENCE)

	SS	Df	MS	F	Sig
Between Group Variance	57.12	3	28.58	.375	N/S
Within Group Variance	6999.43	123	76.08		
Totals	7056.59				

C. F SCORE FOR IMPROVEMENT IN LETTER RECOGNITION (WRITTEN)

	SS	Df	MS	F	Sig
Between Group Variance	61.81	3	30.90	.578	N/S
Within Group Variance	4594.00	123	54.42		
Totals	4655.81				

(Table IX, cont,)

D. F SCORE FOR IMPROVEMENT IN PATTERN RECOGNITION (VERBAL RESPONSE)

	SS	Df	MS	F	Sig
Between Group Variance	21.50	3	10.75	5.63	1%
Within Group Variance	177.46	123	1.91		
Totals	198.96				

E. F SCORE FOR IMPROVEMENT IN PERSISTENCE (LINE WALKING)

	SS	Df	MS	F	Sig
Between Group Variance	25533.86	3	12766.93	25.92	1%
Within Group Variance	45193.13	123	482.40		
Totals	71326.99				

F. SCORE FOR IMPROVEMENT IN BODY PERCEPTION

	SS	Df	MS	F	Sig
Between Group Variance	11.48	3	5.74	.915	N/S
Within Group Variance	538.91	123	6.28		
Totals	550.38				

RESULTS OF THE FIRST TREND TESTS

The data from two Tables (Table IX and Table X), contains information through which comparisons of group improvement by the time the first trend test was given, may be analyzed. The F scores on Table IX reveal that, based upon a one-way analysis of variance using the differences between the pre-test and the first trend tests, there was as much inter-group variance as there was intra-group variance, 3 of the 6 trend tests given (serial memory of movements, body perception, and in letter recognition in sequence). In the other 3 tests, significant inter-group differences in improvement do exist. The tests evaluating letter recognition (via written and verbal response), that evaluating self-control (via the persistence test of slow line walking), as well as the test of the verbal identification of six common geometric patterns, reveal that a significantly greater amount of improvement was registered by one or more of the groups than was true of the others.

The nature of that improvement can be seen upon inspection of Tables II through V, as well as Table XI. These group changes will be discussed, by test, in the paragraphs which follow.

Body Perception Score: Initially, the scores on this test (with a top score of 10 points possible), ranged from 5.72 to 7.37 with the best mean score being posted by the Learning Games Group. After six weeks into the program, at the time the first trend test was adminstered, all the groups had registered improvement in this score, and at the same time, the score of the Learning Games Group had approached the maximum possible of 10 (9.18, S.D. = 1.10).

By the time this trend test was given, after six weeks, the Learning Games Group mean of 9.18 was significantly higher (t=2.52) than the nearest mean score posted by the groups who had received no special physical activity, or by the Tutorial Program (8.07). At the same time, the Learning Games Group was significantly better than the group who had been exposed to classroom tutoring and in which body perception practice had been given verbally (mean of 7.50).

Sixteen out of 35 (46%) of the children in the Learning Games Group posted perfect scores of 10 in this test of body part recognition, by the sixth week of the program; while the results of the children in the other three groups were not comparable. 34% of the children in the Control Group had a perfect score (10 out of 29). Only 9% of the children in the Physical Education Group had a perfect score by the time the first trend tests were administered (3 out of 32), while only 15% or 5 out of 33 of the children given special classroom tutoring, were able to achieve a score of 10 in this test by the sixth week of the program.

Persistence: The persistence of self-control measures evidenced no significant improvement on the part of the children in the Learning Games Group by the time the first trend test was administered. Initially their mean score was 14.71 seconds when asked to walk a line as slowly as they could, and by the sixth week a mean score of 23.44 was posted (Table X). There was no significant difference in this mean score and the means of the group given classroom tutoring (mean = 24.78, t=30), nor that of the Controls (mean = 20.82, t=.86)

Pattern Recognition (Verbal); The verbal identification of the six geometric figures presented to them, was initially difficult for most of the children. As can be seen on Tables II through V, the average scores for the various groups averaged from about two and one-half to three correct, out of six. By the time the first trend test was given, however, two of the groups who had been given special training in this type of task (the Learning Games Group and the Classroom Tutoring Group) were significantly better than the other two groups, based upon comparisons of their mean scores. (Table X).

For example, there was a significant difference (t=5.53) between the score posted by the group given classroom tutoring and the group given physical education. At the same time, there was no significant difference between the mean scores, at this point in the semester, of the children given pattern recognition training in the small group meeting in a classroom (mean = 4.93) and those learning pattern recognition via learning games (mean = 4.62).

Among the children in the latter two groups given special training in pattern recognition, by the sixth week of the program, 18 could name all geometric figures correctly (18%) while only one child in the other two groups could correctly identify the six common geometric figures presented to the children.

TABLE X

MEANS AND STANDARD DEVIATIONS, BY GROUP AND BY TEST, FOR THE FIRST TREND TESTS

A. PHYSICAL EDUCATION GROUP (N=29)

TEST	MEAN	S.D.
1. Body Perception	7.38	2.40
2. Persistence	18.86	9.41
3. Pattern Recognition (Verbal)	3.21	20.24
4. Letter Recognition (Written)	20.24	8.28
5. Letter Recognition (Sequence)	16.96	9.76
6. Serial Memory (Motor-Visual)	5.00	2.85

B. NO ACTIVITY CONTROLS (N=28)

TEST	MEAN	S.D.
1. Body Perception	8.07	2.09
2. Persistence	20.82	9.42
3. Pattern Recognition (Verbal)	3.07	1.49
4. Letter Recognition (Written)	21.57	6.95
5. Letter Recognition (Sequence)	19.82	8.55
6. Serial Memory (Visual-Motor)	5.78	1.93

(Table X, cont.)

C. CLASSROOM TUTORING GROUP (N=30)

TEST	MEAN	S.D.
1. Body Perception	7.50	2.07
2. Persistence	24.68	17.60
3. Pattern Recognition (Verbal)	4.93	.93
4. Letter Recognition (Written)	21.30	5.16
5. Letter Recognition (Sequence)	18.77	9.41
6. Serial Memory (Visual-Motor)	4.88	2.56

D. LEARNING GAMES GROUP, EXPERIMENTALS (N=35)

TEST	MEAN	S.D.
1. Body Perception	9.17	1.10
2. Persistence	23.44	14.22
3. Pattern Recognition (Verbal)	4.62	.88
4. Letter Recognition (Written)	25.12	1.94
5. Letter Recognition (Sequence)	23.82	4.86
6. Serial Memory (Visual-Motor)	5.73	1.71

Letter Recognition (Sequence): The test requiring the children to say the letters of the alphabet in order, was also given during the sixth week of the program as part of the trend test. Again, the children in the Learning Games Group posted a significantly superior mean score (mean = 23.82, as compared to the nearest mean of 19.82 by the Controls, t=2.17). The children in the Learning Games Group were also able to perform significantly better on this test as compared to a mean of 23.82 (t=3.77) (Table XI).

Using the criterion of a perfect score of 26, again, interesting comparisons between the various groups can be made, and the differences are marked. For example, 57% of the children in the Learning Group were able to say the letters of the alphabet in order by the sixth week; while only 34% (10 out of 29) in the Control Group, 38% (12 out of 31) in the Classroom Tutoring Group, and 15% (5 out of 33) in the group receiving physical education, were able to do so by this time in the program.

Serial Memory (Visual-Motor): The serial memory task administered partly through the program in the trend tests, was similar to the training received by the Learning Games Group[3]

Letter Recognition (Written): In the test involving whether or not the children could identify verbally letters of the alphabet and then write them correctly after the letter had been removed from sight, again the mean scores by the children in the Learning Games Group were significantly higher (mean = 25.12, t=3.77) than the mean scores of the children in the group scoring next-highest (Classroom Tutoring Group mean = 21.30). However, it should be remembered (Tables II through V) that initially, the mean score of the children placed in the Learning Games Group was higher than those of the other three groups. However, initially these differences were not significant. The t score obtained is 1.18 when the initial means in this test of letter recognition by the Learning Games Group (mean = 22.34) is compared to that of the group scoring next-highest in the pre-testing period (Controls' mean = 20.62).

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[3] A child had to copy, in correct sequence, the movements of another child within various configurations on the floor.

Thus by the time of the administration of the first trend test, the Learning Games Group had achieved significantly higher overall scores in this test than had any other group, while initially this was not true. Further illustrating this point, is the finding that by the sixth week of the program during which the trend tests were given, 24 out of 35 (68% of the children in the Learning Games Group were able to say and to write all 26 letters of the alphabet, while less than one-half as many children in the other groups were able to do so. Only 10 children in the Classroom Tutoring Group achieved a perfect score on this test (out of 31, or 32%) by the sixth week; while the same number in the Control Group (out of 29, or 43%) achieved a perfect score, with even fewer in the group having only special physical education (6 out of 33, or 18%) were able to write and say all 26 letters of the alphabet by the time of the first trend test.

Overall, the mean score in serial memory for movements, of the children in the Learning Games Group was not significantly higher than that achieved by the Control Group at this point in the program (Controls' mean=5.78 and Learning Games mean=5.72).

Summary of the Data: First Trend Test

By the time the program had progressed for six weeks, it was found that the children in the Learning Games Group and the group given special tutoring, had achieved significantly higher scores in the verbal identification of geometric figures than had the children in the other two control groups ("No Activity" Control and Physical Education Group).

The ability to remember, in correct order, the total body movements of another child and the ability to exhibit self-control by the children in the Learning Games Group, were comparable to the scores achieved by the children in the other three groups.

On the other hand, the two measures of letter recognition revealed significantly higher scores on the part of the children exposed to learning games. For example, 68% of the children in the Learning Games Group could verbally identify and write all 26 letters of the alphabet and 57% of the children in this same group could say all the letters of the alphabet in correct order, while less than one-third of the children in the groups exposed to special classroom tutoring or to physical education activities could identify all the letters of the alphabet in order when asked to do so by the sixth week of the program.

It was also found that the scores in the measures of body perception administered by the time the first trend tests were given, were significantly higher among the children in the Learning Games Group, as compared to the other groups. During the initial pre-testing period, these differences were not seen when the average scores were contrasted.

RESULTS OF THE SECOND TREND TESTING

The same six tests were given during the 12th week of the program on Tuesdays and Thursdays, in order not to interfere with the educational programs in progress. Analysis of Variance based upon differences between pre-test scores and second trend test scores, by group and by test, (Table X) revealed that there were significant inter-group differences in measures of pattern recognition (verbal), and persistence (slow line walking). It is believed, however, that more revealing are the data appearing on Table XI, which permit comparisons of performance levels reached by each of the groups in the six tests given to these children two-thirds of the way through the school semester. These results will be analyzed by test in the paragraphs which follow.

Body Perception: By the time the second trend test was given, the superiority of the Learning Games Group had to some degree disappeared. The Classroom Tutoring Group, for example, had in some tests "caught up with them." At the same time, however, the differences in the mean scores between these two groups, indicated significant superiority on the part of the Learning Games Group (mean = 8.73 versus 7.72 for the Classroom Tutoring Group (t=2.18 significant at the 5% level). The mean scores for the two other groups were significantly below these.

Twelve out of 34, over one-third of the children in the Learning Games Group, scored a perfect 10 on this test, evidencing the ability to identify left-right body parts and to make even more complex judgements about their body, i.e. "touch your left hand to your right knee", while only 8 in the tutored group and in the Physical Education Groups scored 10 on this test. Even fewer, about 10% of the children in the Special Tutoring Group could score 10 on this test by the 12th week.

Persistence: In the line walking measure of self-control, the Learning Games Group scored significantly higher than any other group by the 12th week. As was stated, there were no significant differences in these groups by the 6th week; however by the time of this second trend test, the Learning Games Group took,on the average, almost a minute (57.94 seconds) to walk a 12' line "as slowly as you can," while the group scoring nearest to them, the children exposed to special physical education, achieved a mean of 25.79 seconds in this same task (t=4.96)

At the same tame, Table XII reveals that there was a wide distribution of the scores in persistence achieved by the Learning Games Group by the 12th week (SD 34.73 seconds), and thus the performances recorded were highly specific and unique to each child. Many seemed to understand what slow meant, and to become willing to place themselves under strict control by this time in the semester in this type of task, while still others were not able and/or willing to exhibit the same amount of self-control.

Pattern Recognition (Verbal): Again the two groups in which pattern recognition had been taught, the Learning Games Group and the Classroom Tutoring Group, scored significantly better than did the other two groups on the ability to recognize and name six geometric figures. As can be seen in Table XII, the average scores for the Controls and for these children in the Physical Education Group was about 3 to 3.5 correct out of 6, while the children in the other two groups scored about 5 out of 6 correct. The differences between the Classroom Tutoring Group's mean of 5.16, and that posted by the children in the Physical Education Group of 3.55, was significant at the 5% level of confidence. (t=5.50)

A tabulation indicated that about one-half of the children in the Tutoring Group (16 out of 30), and in the Learning Games Group (18 out of 35) could name all 6 geometric figures correctly by the 12th week of the program, whereas only a small percentage of the children in the other groups could do so (1 out of 29 in the Physical Education Group, and 1 out of 28 in the Control Group).

Letter Recognition (Written): In the task involving the random presentation of the 26 letters of the alphabet, which required the child to first say the letter and then, after it

TABLE XI

MEANS AND STANDARD DEVIATIONS, BY GROUP AND BY TEST, IN SECOND TREND TESTING

A. PHYSICAL EDUCATION GROUP (N=29)

TEST	MEAN	S.D.
1. Body Perception	7.48	2.19
2. Persistence	25.79	13.54
3. Pattern Recognition (Verbal)	3.55	1.30
4. Letter Recognition (Written)	22.38	5.33
5. Letter Recognition (Sequence)	18.96	8.77
6. Serial Memory (Visual-Motor)	5.93	2.50

B. NO ACTIVITY CONTROLS (N=28)

TEST	MEAN	S.D.
1. Body Perception	7.35	2.27
2. Persistence	25.61	10.92
3. Pattern Recognition (Verbal)	2.95	1.50
4. Letter Recognition (Written)	24.61	3.05
5. Letter Recognition (Sequence)	22.12	5.84
6. Serial Memory (Visual-Motor)	5.61	2.13

C. CLASSROOM TUTORING

TEST	MEAN	S.D.
1. Body Perception	7.73	24.23
2. Persistence	24.23	5.16
3. Pattern Recognition (Verbal)	5.17	1.01
4. Letter Recognition (Written)	23.33	2.71
5. Letter Recognition (Sequence)	21.03	7.00
6. Serial Memory (Visual-Motor	5.56	2.17

D. LEARNING GAMES GROUP, EXPERIMENTALS (N=35)

TEST	MEAN	S.D.
1. Body Perception	8.75	1.70
2. Persistence	57.94	34.73
3. Pattern Recognition (Verbal)	5.20	1.03
4. Letter Recognition (Written)	25.70	.67
5. Letter Recognition (Sequence)	25.55	1.09
6. Serial Memory (Visual-Motor)	6.45	1.81

was removed from sight, to write each one; the following results were seen by the 12th week.

The Learning Games Group performed significantly better than did the children in the group given special classroom tutoring. In the former group, the mean was 25.70, while in the latter, the mean score was 23.33 (t=4.50). At the same time, by this week in the semester, the children in the Control Group who were exposed to regular classroom teaching without the addition of any special program, also scored reasonably high in this task, a mean of 24.61, which was not significantly superior to the mean of the Learning Games Group (t=1.81).

Again, with reference to a perfect score in this test of 26 out of 26 letters of the alphabet correctly identified verbally and in writing, the following tabulations were made. Again the superiority of the Learning Games Group was indicated, as 80% of these children could correctly identify verbally and write all 26 letters of the alphabet (28 children out of 35), while only 30% (9 out of 30 children) in the group receiving special classroom tutoring could do so; and 34.4% of those in the Physical Education Group could do so (10 out of 29 children). In the "No Activity" Control Group, 18 out of 28 children (64%) could at this point identify verbally and in written form, all of the 26 letters of the alphabet. However, 5 of these 18 perfect scores came from children who were given special tutoring 5 days of the week in a program initiated after this experimental program had begun, and which has been referred to previously.

Letter Recognition (Sequence): The findings in this task (saying the letters of the alphabet in order), by the 12th week, parallel those data discussed in the previous section. The Learning Games Group was significantly superior, posting a mean score of 25.55 out of a possible 26. This was significantly higher than that posted by the group given special classroom tutoring, of 21.03 (t=3.45), and by the group given no special instruction (mean 22.12, t=3.12).[4]

Tabulation of data based upon the perfect execution of this task, 26 out of 26 correct, revealed the following: While 77% (27 out of 35 of the children in the Learning Games Group) were able to score 26 on this task, less than 40% of the children in the other three groups were able to do so. Only 31% of the children in the Special Classroom Tutoring Group (39%) were able to verbally repeat the alphabet in order. Five additional children in the Learning Games Group were able to recite the alphabet with only one error, posting scores of 25.

Serial Memory (Visual-Motor): The mean score of the children in the Learning Games Group was not significantly superior to the mean scores of those in the other two groups, by the 12th week of the semester, at the time this second trend test was administered.

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[4] With the exception of the children in this last group in the second grade, nine of whom were given daily classroom tutoring in small groups as part of another federal program.

Summary of Data on Second Trend Test.

In summary, it was found that the mean score of the Learning Games Group was significantly superior to that of the other three groups in the tests of body perception, self-control (persistence), and in both measures of letter recognition (verbal responses-written responses, and saying the alphabet in order). 80% of the children in the Learning Games Group could verbally identify and write all the letters of the alphabet by this time in the semester, whereas only about 30% in the Classroom Tutoring Group could do so. 77% of the children in the Learning Games Group could order the letters in the alphabet properly when reciting it, whereas less than 40% of the children in the other three groups could do so.

The children in the Learning Games Group, and in the Classroom Tutoring Group could identify almost all of the 6 geometric figures correctly, whereas the children in the other two groups could on the average, identify only about half of the figures presented to them.

The children in the Learning Games Group posted scores which were comparable to those in the other groups, in the test of serial memory ability involving the ability to watch and repeat a series of body movements performed first by another child.

DATA ANALYZED BY GRADE LEVEL

Within the following section, analysis of the data by grade is made, with an effort to focus upon pre- and post test comparisons, as well as to survey the mean scores obtained from the two trend tests. Analysis of the information obtained from the first grade children has been subjected to a more thorough analysis than that obtained from children in the upper three grades. Consideration of the data derived from this survey should result in movement curricula which are most suited to individual needs within various maturity levels.

FIRST GRADE

Tables XII and XIII contain data from the children in the first grades, by school. The first of these tables contains selected pre- and post test means (Table XII) while the second is a survey of the trend tests obtained from the scores of the first graders.

Persistence: In general, Table XII reveals that better terminal scores were obtained on self-control from the children in the first grade who were exposed to physical education, than from those taking part in learning games or in the other two groups. However, these terminal differences are not statistically significant, due to the small number of subjects within each group and the large standard deviations.

Pattern Recognition (Verbal): In general, the data indicates that the first grade children in the Classroom Tutoring and Learning Games Groups could verbally identify from, on the average, 4.5 to 5.4 geometric shapes out of six presented, while the children in the other two groups exhibited the ability to identify, on the average, from 1.6 to 3.2 correctly.

A survey of this data indicates that 7 out of 11 of the first grade children in the Learning Games Group could verbally identify 5 or 6 of the 6 geometric shapes correctly, while 8 out of 9 of the children in the Classroom Tutoring Group could score 5 or 6 correct in the post tests. In contrast, only 2 out of 10 of the children in the Control Group and none of the 8 children in the group having only special physical education, could do so at the completion of the 18-week program.

Letter Recognition (Verbal): Three groups of first graders, by the time of the post test could, based upon the mean scores, do well in the verbal identification in random order of the letters of the alphabet. The mean scores of the first grade children within the Learning Games Group, the Controls, and the group receiving classroom tutoring, ranged from 25.3 to 25.5. The children within the group receiving physical education, however, posted a final mean score of only 17.1 (out of 26). Only 1 out of 8 children in this latter group could verbally identify all 26 letters of the alphabet by the end of the 18-week period.

This test was not contained in the trend test batteries so that the rate of progress to the final scores cannot be ascertained on the part of the first graders in the program. This type of trend analysis is carried out, however, in the two sections which follow.

Letter Recognition (Written): In this test, the child was required to verbally identify, and then when the letter was removed, to write the letter of the alphabet. The letters were presented one at a time. As can be seen upon inspection of Table XIII, the children in the Classroom Tutoring Group and in the Learning Games Group performed significantly better than did the children in the Control and Physical Education Groups. The former two groups posted final mean scores of 24.5 and 24.9, while the scores of the latter two groups were significantly lower (15.8 for the Physical Education Group, and 22.4 for the group receiving no special help).

Analysis of the number of first graders achieving a perfect score of 26 on this test by the end of the program, by group, revealed that 100% of the first grade children in the Learning Games Group could name 25 or 26 letters correctly (7 had a score of 26, and 4 a score of 25). However, only one out of 8 in the Physical Education Group achieved a perfect score and an additional three had a score of 25 (37.5%). 44% had a score of 26 in the Special Tutoring Group (4 out of 9), none had a score of 25 in this group; while only 5 out of 10 first grade children in the Control Group had a final score

TABLE XII

COMPARISON OF SCORES ON PRE- AND POST TESTS BY FIRST GRADERS, IN FOUR GROUPS

		PRE-TEST		POST TEST	
TESTS		NO ACTIVITY CONTROLS	LEARNING GAMES	NO ACTIVITY CONTROLS	LEARNING GAMES
Persistence	M	13.5	10.5	23.3	16.2
	SD	4.4	2.6	10.0	9.1
Pattern Recog. (Verbal)	M	2.2	2.5	3.2	4.5
	SD	1.7	1.0	1.2	1.1
Letter Recog. (Verbal)	M	12.4	18.0	25.5	25.5
	SD	10.3	7.0	1.2	0.9
Letter Recog. (Written)	M	10.2	16.5	24.2	25.6
	SD	9.5	6.5	1.7	0.5
Letter Recog. (Sequence)	M	7.9	13.1	22.4	24.9
	SD	9.1	7.6	6.6	2.9
Serial Memory (Auditory)	M	4.8	4.8	6.0	5.5
	SD	1.8	0.7	1.6	1.5
Serial Memory (Visual)	M	1.9	2.8	4.8	5.6
	SD	2.1	1.8	2.7	1.6
Serial Memory (Visual-Motor)	M	5.6	5.3	5.5	5.8
	SD	1.5	1.7	1.3	1.4
Spelling	M	0.9	1.5	3.9	7.5
	SD	1.4	3.4	2.9	2.9

TABLE XII (Continued)

		PRE-TEST		POST TEST	
TESTS		PHYSICAL EDUCATION	CLASSROOM TUTORING	PHYSICAL EDUCATION	CLASSROOM TUTORING
Persistence	M	13.5	11.3	25.9	17.2
	SD	4.4	3.2	10.9	14.2
Pattern Recog. (Verbal)	M	2.2	2.8	1.6	5.4
	SD	1.7	1.3	1.3	0.8
Letter Recog. (Verbal)	M	6.7	12.3	17.1	25.3
	SD	7.9	8.7	8.7	1.0
Letter Recog. (Written)	M	4.4	10.0	15.8	24.5
	SD	5.6	7.2	10.0	1.6
Letter Recog. (Sequence)	M	0.9	2.0	13.9	18.3
	SD	2.8	2.4	9.4	6.03
Serial Memory (Auditory)	M	3.5	5.2	6.5	5.0
	SD	1.2	1.2	1.5	1.2
Serial Memory (Visual)	M	1.9	2.1	3.5	5.1
	SD	2.1	1.9	3.6	2.1
Serial Memory (Visual-Motor)	M	5.7	5.2	7.0	5.3
	SD	1.6	1.2	1.2	2.0
Spelling	M	0.5	0.9	0.8	5.5
	SD	0.5	2.0	1.1	3.3

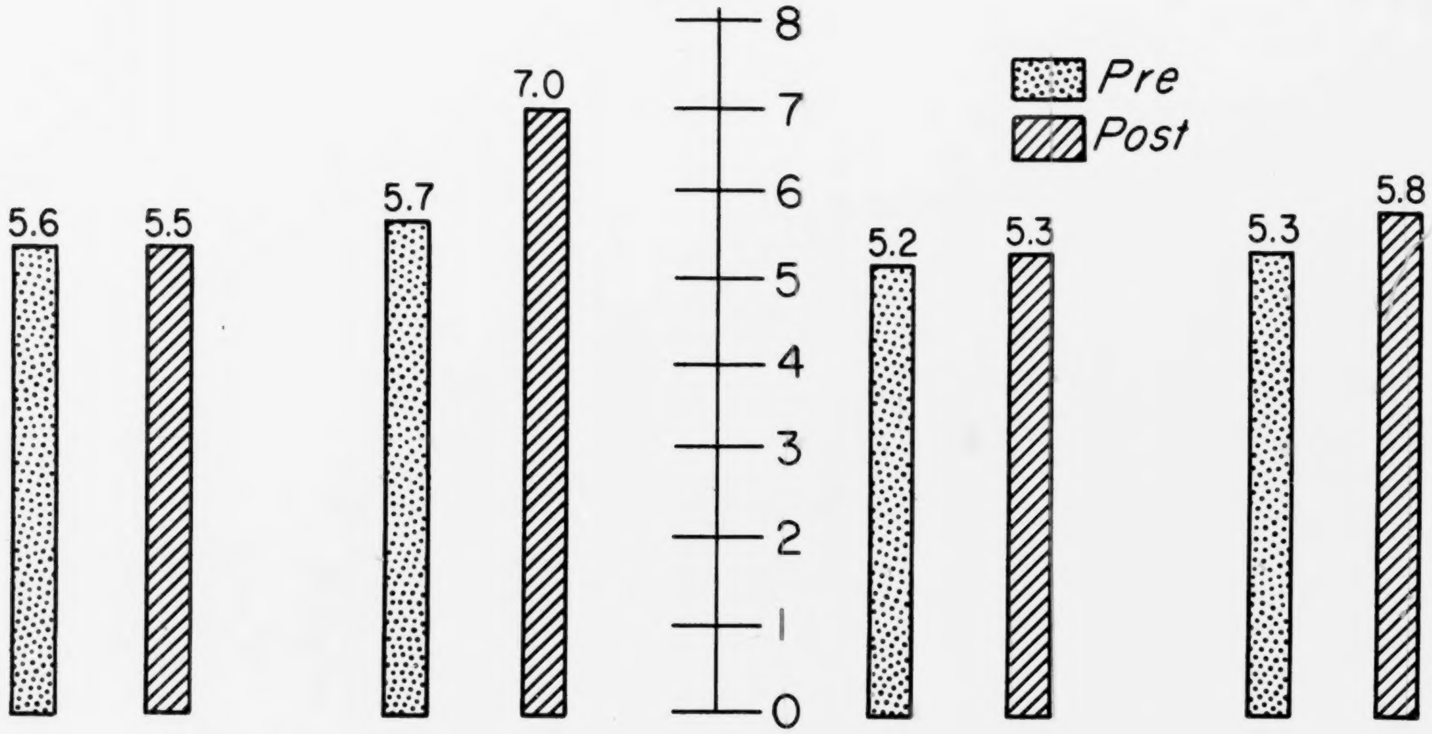
TABLE XIII

COMPARISON OF PRE-, TREND TEST1, TREND TEST2, AND POST TEST ALL GROUPS, FIRST GRADE ONLY, LETTER RECOGNITION (WRITTEN)

		CONTROLS (NO ACTIVITY)				PHYSICAL EDUCATION				TUTORING				LEARNING GAMES			
		Pre	T.1	T.2	Post	Pre	T.1	T.2	Post	Pre	T.1	T.2	Post	Pre	T.1	T.2	Post
Letter Recognition (Written)	M	10.2	15.3	22.6	24.2	4.4	7.8	16.4	15.8	10.0	18.3	21.6	24.5	16.5	22.3	25.5	25.6
	SD	9.5	9.1	4.3	1.7	5.6	6.9	6.7	10.0	7.2	5.8	2.9	1.6	6.5	3.9	.8	.5

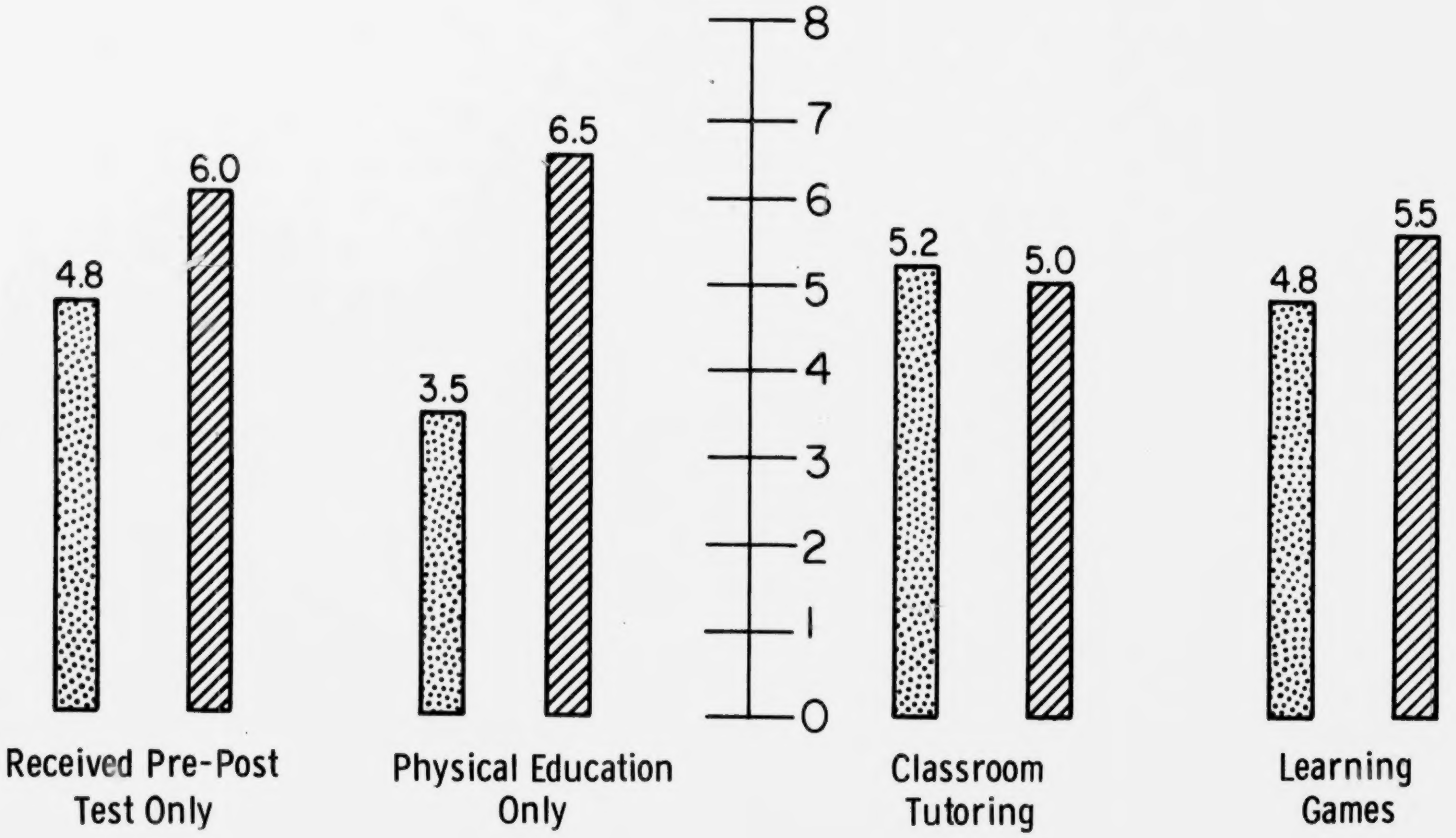
PRE- AND POSTTEST SCORES OF FIRST GRADERS
IN SERIAL MEMORY OF ACTIONS, VISUAL CUES, BY GROUP

Figure 1



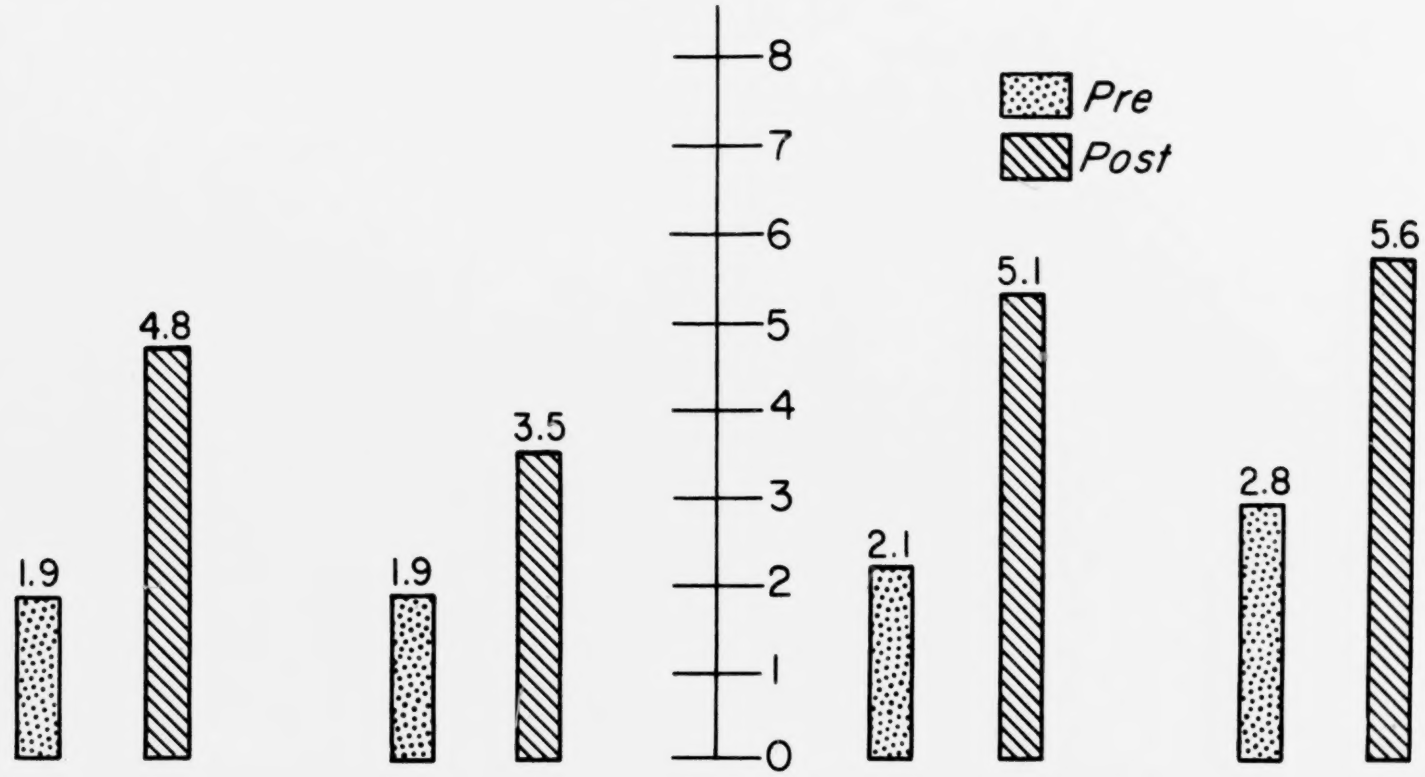
PRE- AND POSTTEST SCORES OF FIRST GRADERS
IN SERIAL MEMORY OF NUMBERS, AUDITORY CUES, BY GROUP

Figure 2



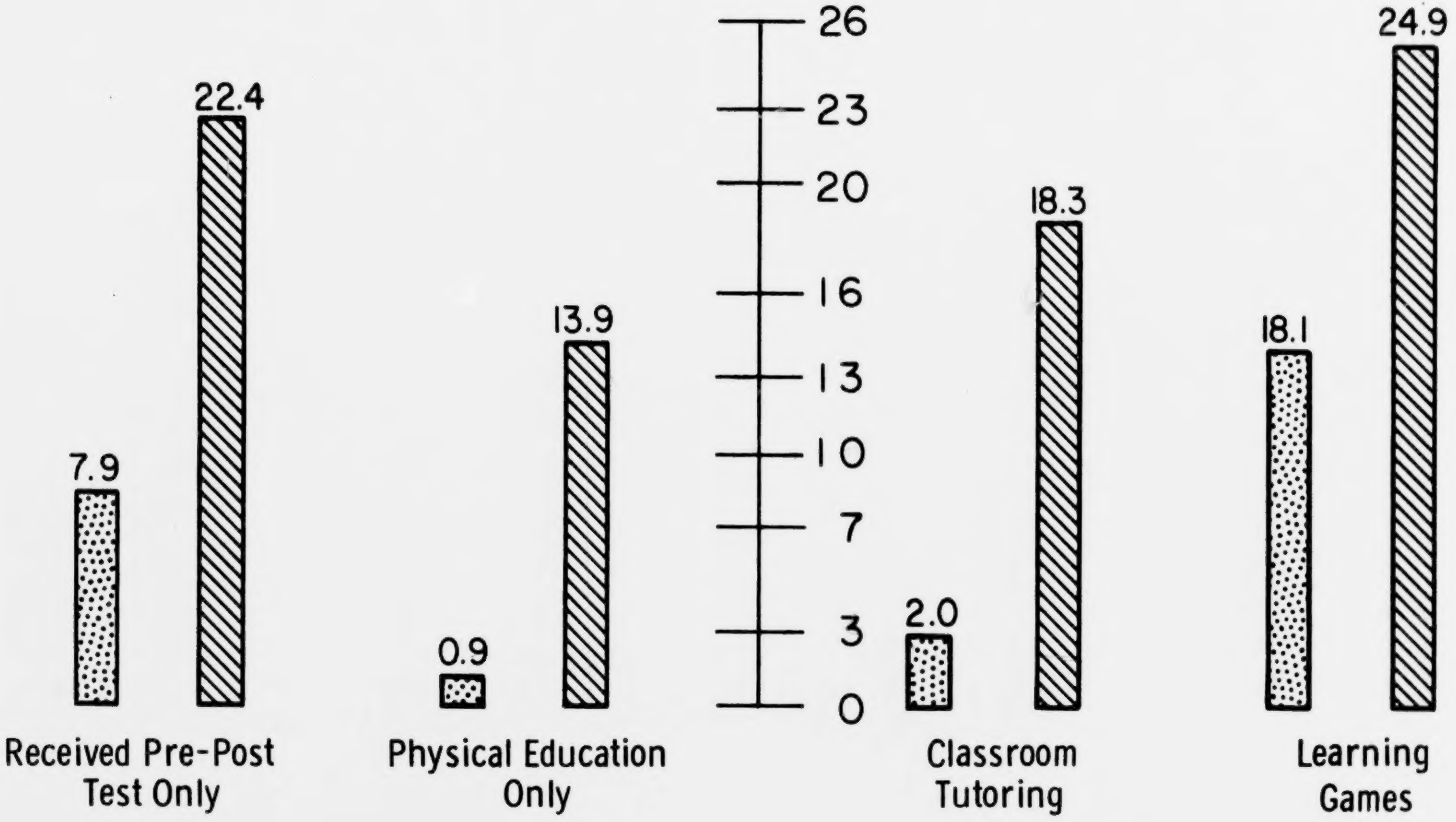
PRE- AND POSTTEST SCORES OF FIRST GRADERS IN SERIAL MEMORY OF LETTERS, VISUAL CUES, BY GROUP

Figure 3



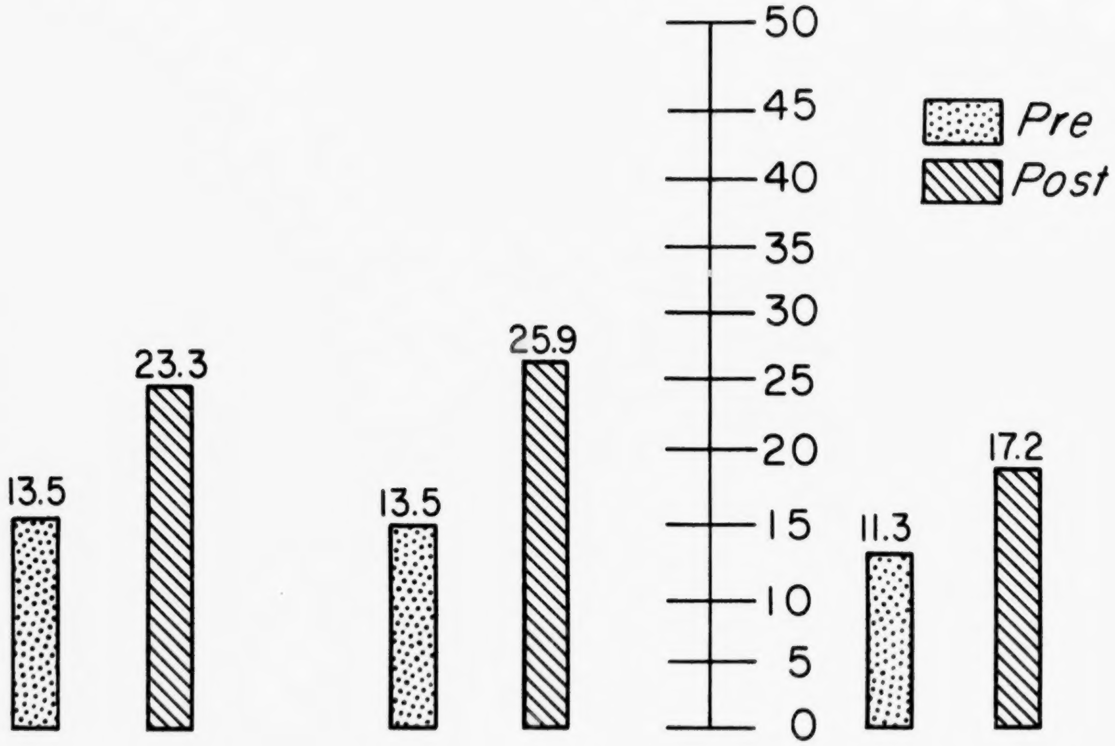
PRE- AND POSTTEST SCORES OF FIRST GRADERS IN ALPHABET SEQUENCE, VERBAL AND MOTOR RESPONSE, BY GROUP

Figure 4



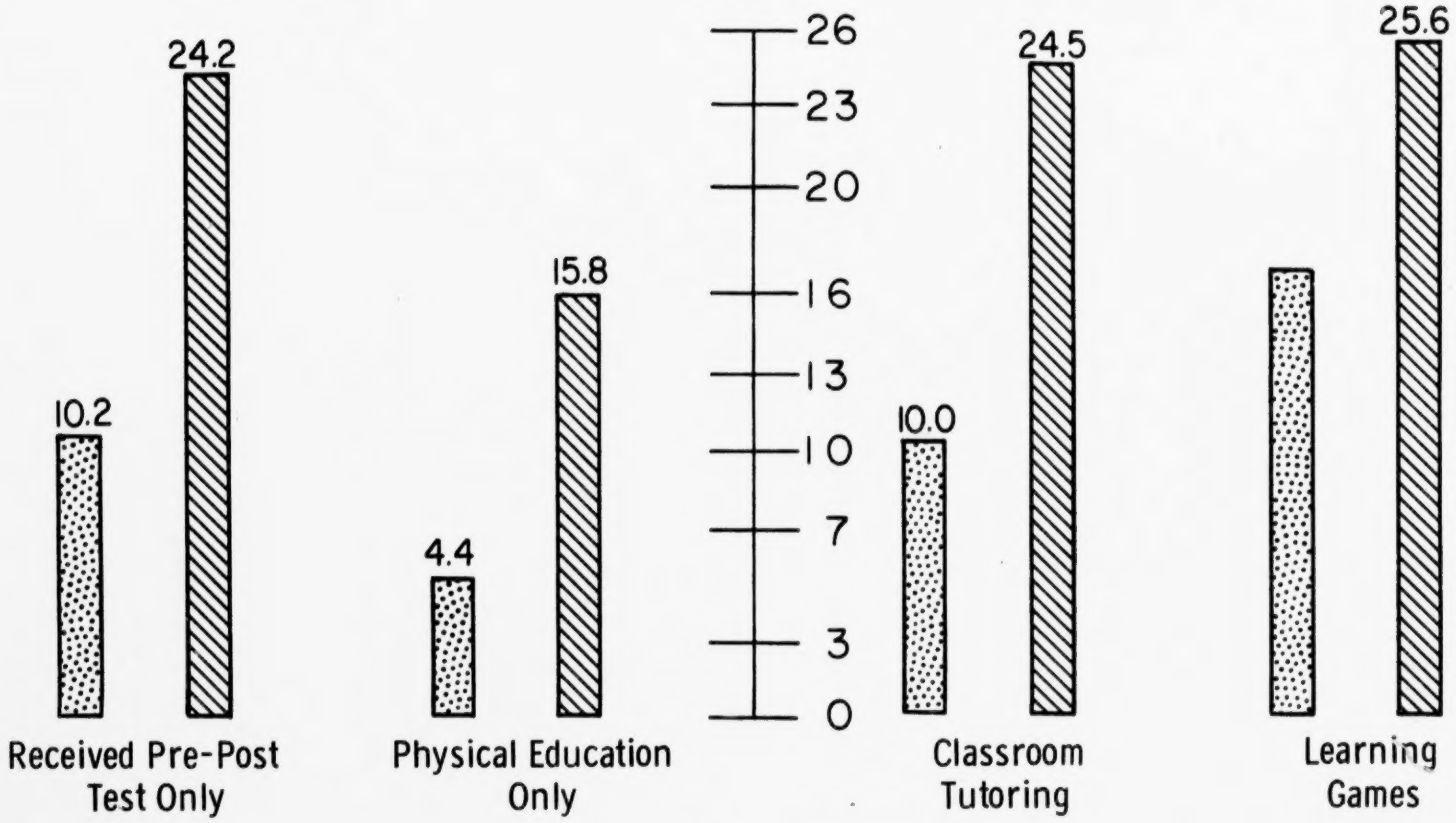
PRE- AND POSTTEST SCORES OF FIRST GRADERS IN PERSISTENCE, BY GROUP

Figure 5



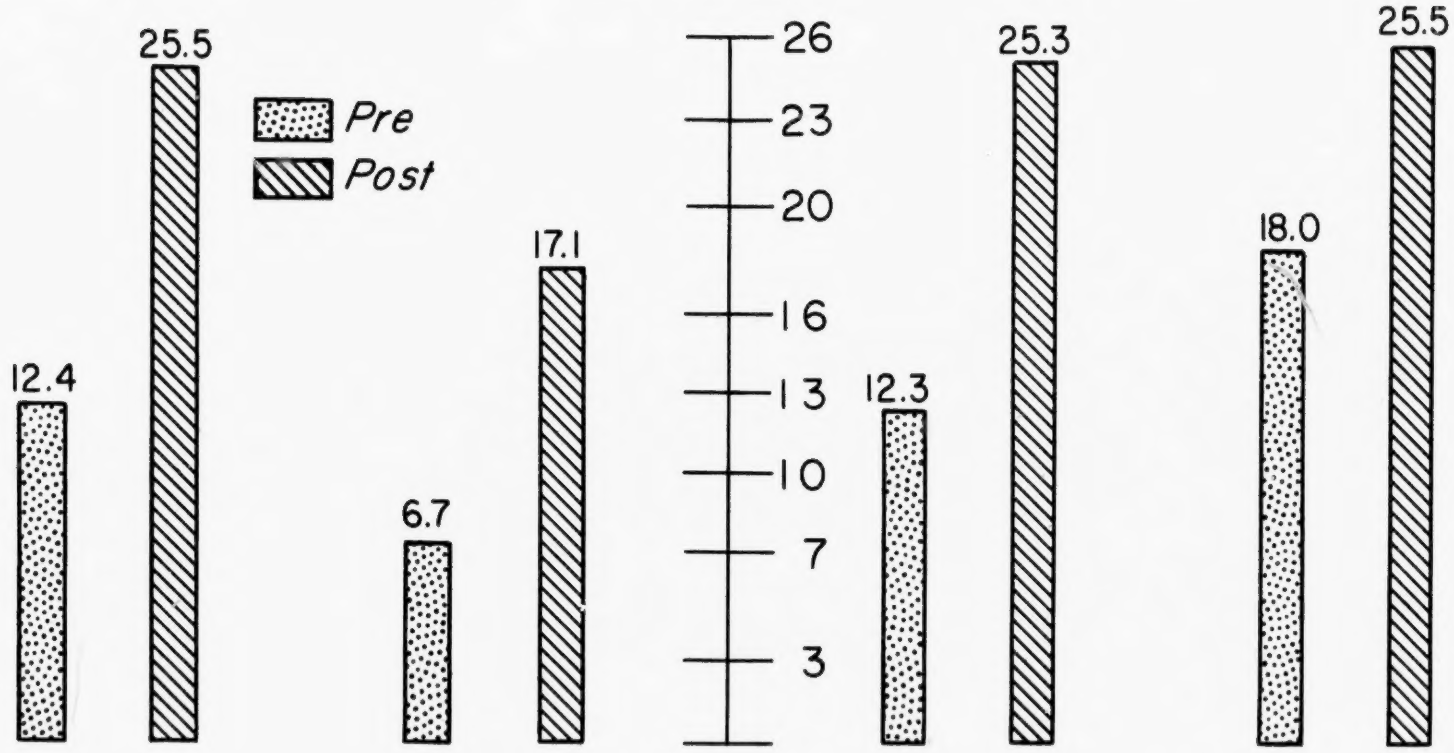
PRE- AND POSTTEST SCORES OF FIRST GRADERS IN LETTER RECOGNITION, WRITTEN RESPONSE, BY GROUP

Figure 6



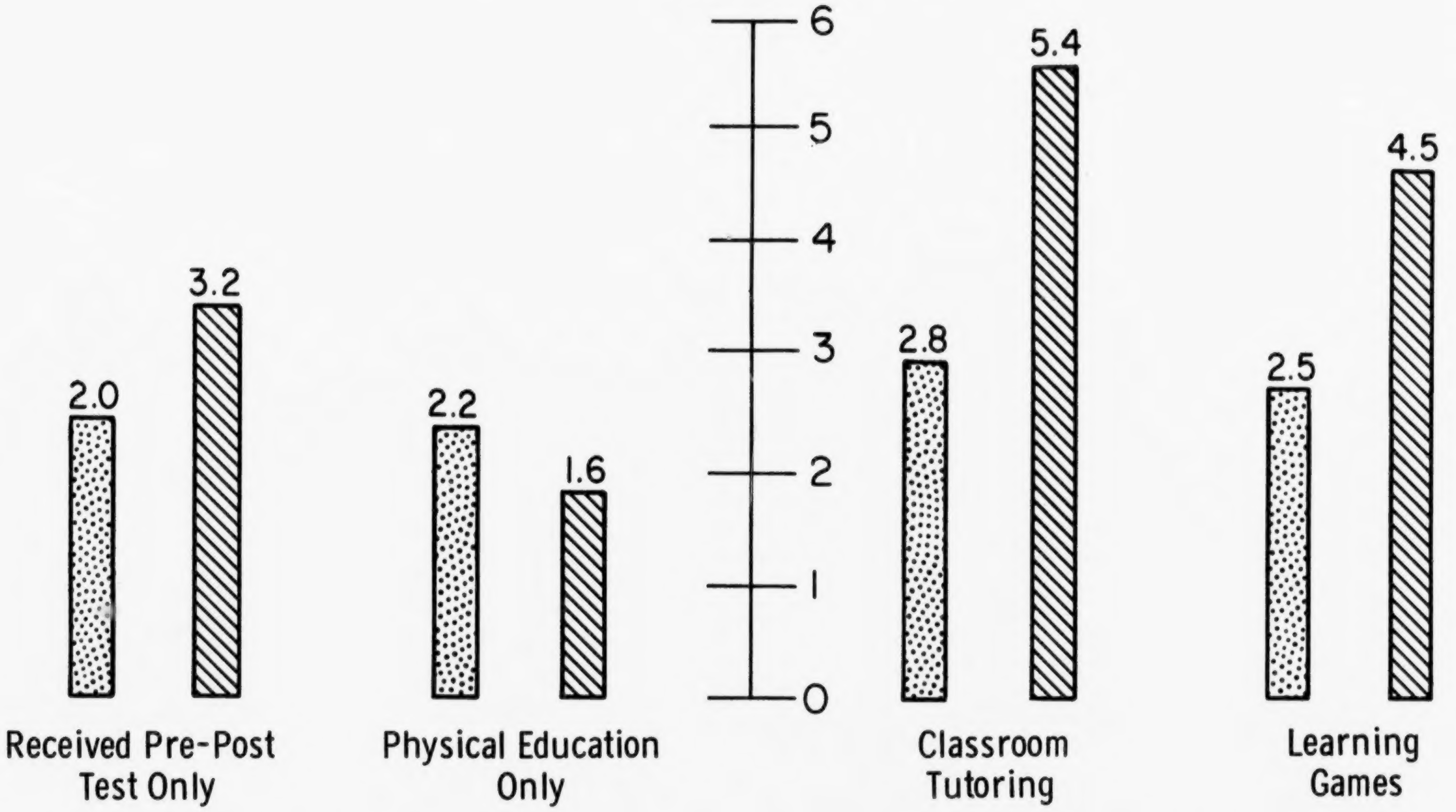
PRE- AND POSTTEST SCORES OF FIRST GRADERS IN LETTER RECOGNITION, VERBAL RESPONSE, BY GROUP

Figure 7



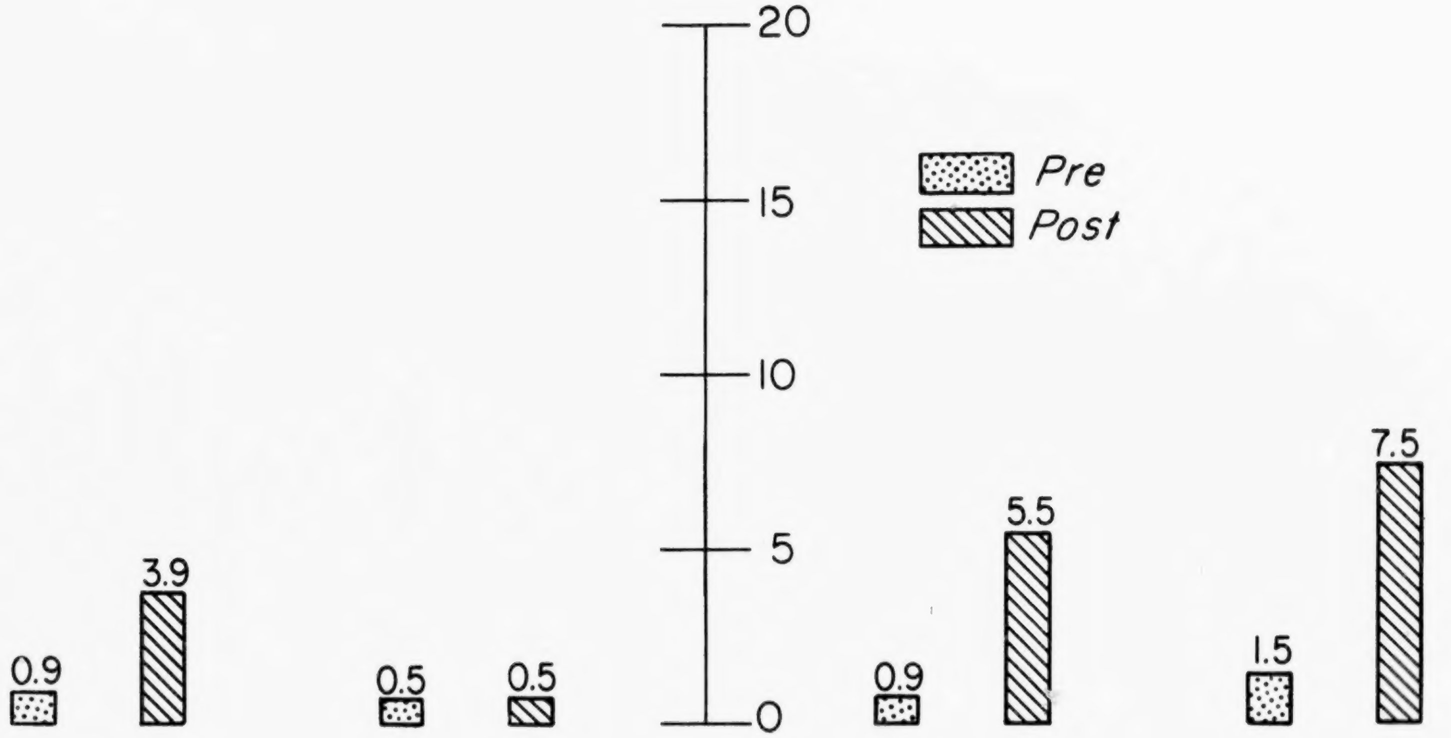
PRE- AND POSTTEST SCORES OF FIRST GRADERS IN PATTERN RECOGNITION, VERBAL RESPONSE, BY GROUP

Figure 8



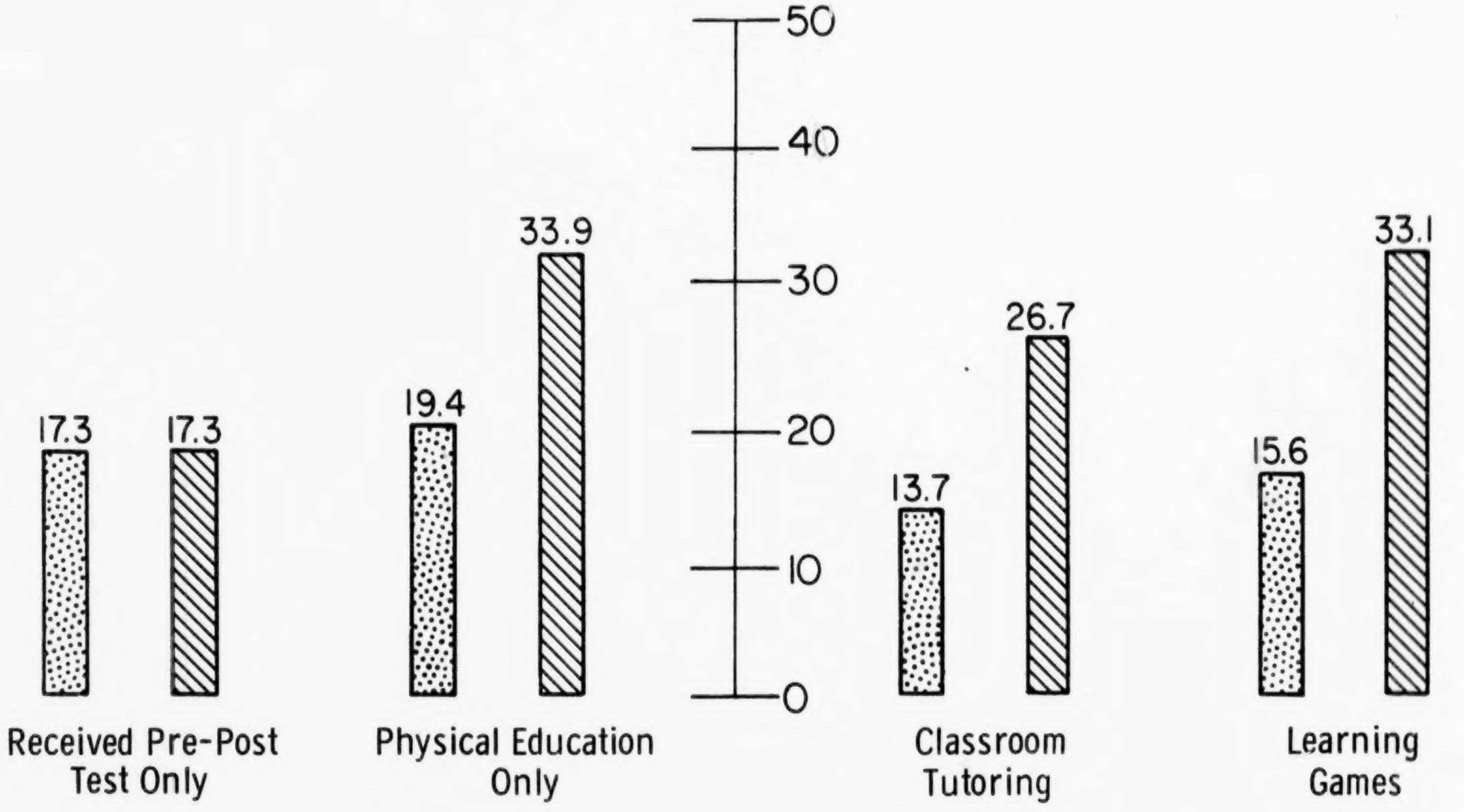
PRE- AND POSTTEST SCORES OF FIRST GRADERS IN SPELLING, BY GROUP

Figure 9



PRE- AND POSTTEST SCORES OF SECOND GRADERS IN PERSISTENCE, BY GROUP

Figure 10



of 25 or 26 on this test (2=26 and 3=25).

As can be seen on Table XIII, the improvement on the part of the first graders in the written and verbal identification of letters was more rapid than the progress shown on the part of the first graders in the other groups. By the first trend test, for example, the Learning Games first graders posted a mean score of 22.3, while that of the Special Tutoring Group was only 18,3. By the time of the second trend test, the differences in these two groups was statistically significant ($t=4.08$).

By the time the post tests were given, 9 out of 11 (82%) of the first grade children in the Learning Games Group could correctly order and verbally repeat all 26 letters of the alphabet while the performance of the other three groups in this task was considerably poorer. For example, only one out of 9 of the children given special classroom tutoring, could do so (11%), 2 out of 8 in the Physical Education Group (25%), and 5 out of 10 in the Control Group (50%) achieved a perfect score of 26 on this test.

Serial Memory (Auditory): In general, upon reference to Table XIII, the improvement and final performance of the children in the Learning Games Group was similar to that of the other groups in this test. This test involved the ability to remember and repeat back in order, numbers given orally by the tester. In general, the children in all groups progressed from the ability to remember about 4 to 5, until a final score of 6.

Serial Memory (Visual): The scores reflecting the ability to remember the order of a series of pictures presented visually, again reflected little significant inter-group difference on the part of the first graders tested. However, the children given special classroom tutoring, posted final scores of from 5.1 to 5.6 in this task, while those receiving no special attention to their academic needs,progressed only to scores of 3.5 and 4.8.

Serial Memory (Visual-Motor): While the final scores for this test were roughly comparable (Table XII), this task was given as part of the trend testing. By the first trend test, the score achieved by the Learning Games Group was 5.80, with the remainder ranging from 4.45 (Controls) to 3.10 for the Tutorial Group and 2.44 for the Physical Education Group. By the time the second trend test was given, again the Learning Game means were the highest (6.10) while those of the other groups were lower, 4.6 for the Controls, 3.75 for the Physical Education Group, and 4.6 for the Tutorial Group.

Thus it appeared that specific practice on the part of the children in the Learning Games Group did indeed improve this score, as would be expected, at a more rapid rate than was seen in the scores of the various control groups.

Spelling: The final spelling test scores of the children in the first grade, appear on Table XIII. As can be seen, the children in the Learning Games Group were, as a group, better than those in the other three groups (7.5 out of 20, as contrasted to scores ranging from 0.8 to 3.9).

Summary of the Data Collected From First Graders.

In general, the first graders exposed to learning games evidenced faster improvement in the various tests of letter recognition and final scores which were higher than the first grade children in the other groups. The tests of serial memory ability, with the exception of the test which matched the training exercises to which the first graders in the Learning Games Groups were exposed, evidenced no inter-group significant differences.

First grade children in the Learning Games Group posted a higher final mean score in the spelling test, while at the same time, the first grade children evidenced no significant inter-group differences in the measure of persistence used in the study. The first grade children in the Classroom Tutoring Group and those in the Learning Games Group, scored higher than did the children in the other groups in the task reflecting the ability to verbally identify 6 common geometric figures.

SECOND GRADE

The nine second grade children in the so-called "No Activity" Control Group were, as has been mentioned, given special help from a federally-sponsored reading teacher for 45 minutes a day, five days per week. This program was instituted shortly after the children earmarked for the subject program were initially tested. It was decided to retain these children but at the same time, some of the data which follows, may reflect distortion due to this tutoring.

Persistence: As can be seen on Table XV, the final measures of persistence (or self-control), posted by the Learning Games school and the group exposed to special physical education, are comparable. (mean of 33.1 seconds, to a mean of 33.9 seconds.)

Pattern Recognition (Verbal): As was true with the first graders and with the total subjects, the children exposed to special training in pattern recognition, whether in a classroom or in the form of learning games, posted scores higher, about 5 out of 6 verbally identified correctly as contrasted to the groups of children who did not receive such training in the other two groups (final means of 3.4 and 2.9).

Inspection of the trend test batteries in which this task was included, indicates that by the first trend test, 7 out of 8, and 7 out of 9 children in the Learning Games Group and the Tutorial Group, could identify from 5 to 6 of the 6 geometric figures correctly; while at this same point, six weeks after the beginning of the program, only one out of the eight children in the Physical Education Group, and one out of the four children in the Control Group could identify 5 or 6 figures correctly.

TABLE XIV

COMPARISON OF PRE- AND POST TEST MEANS OF SECOND GRADE CHILDREN, BY GROUP

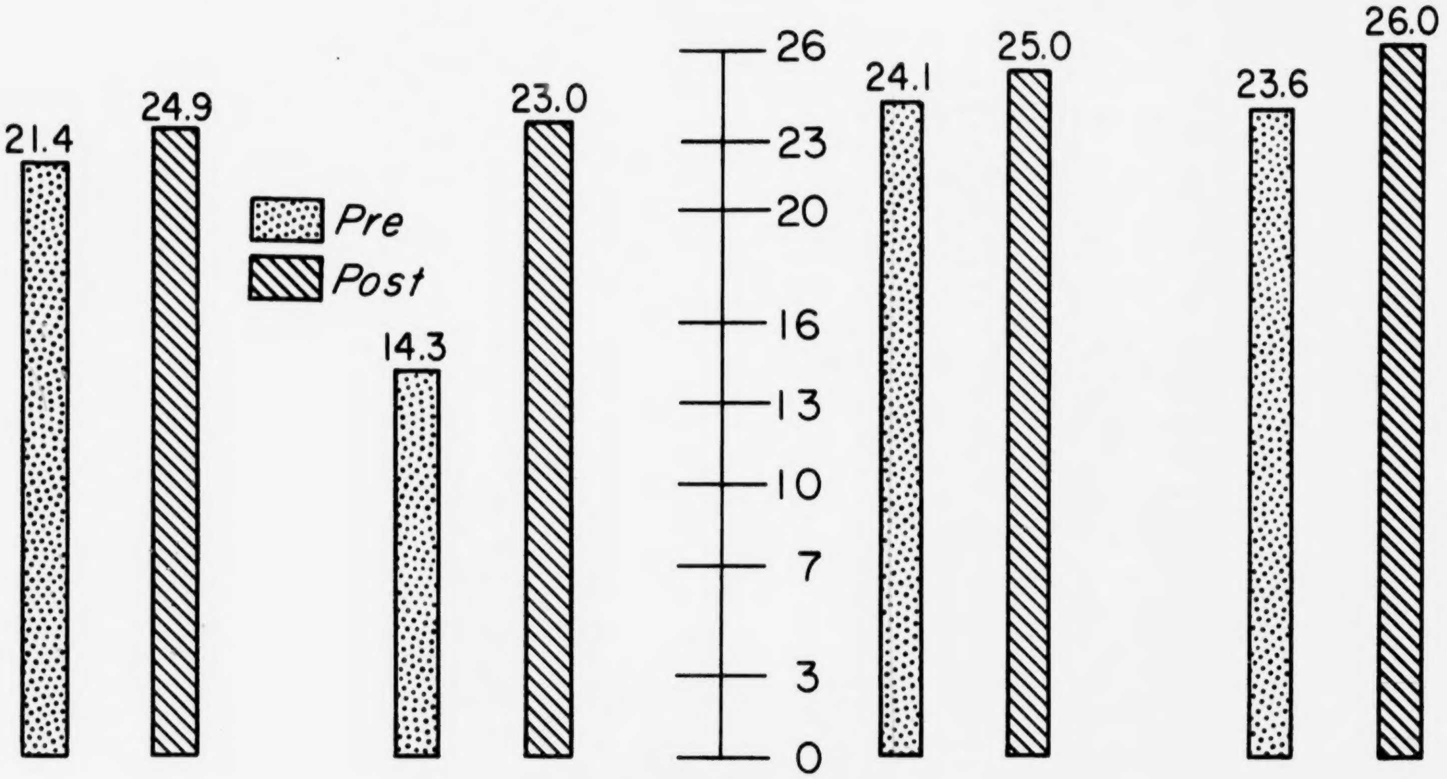
		PRE-TEST		POST TEST	
TEST		PHYSICAL EDUCATION	TUTORING	PHYSICAL EDUCATION	TUTORING
Persistence	M	19.4	13.7	33.9	26.7
	SD	7.5	4.5	9.9	21.1
Pattern Recog.	M	2.8	3.1	3.4	5.3
(Verbal)	SD	1.0	1.3	0.9	1.1
Letter Recog.	M	23.8	25.5	25.7	25.9
(Verbal)	SD	4.2	0.7	0.5	.29
Pattern Recog.	M	22.3	24.6	25.3	25.9
(Written)	SD	5.6	0.9	1.2	.29
Letter Recog.	M	14.3	24.1	23.0	25.0
(Sequence)	SD	9.5	1.9	4.8	1.7
Serial Memory	M	5.0	5.7	5.0	5.7
(Auditory)	SD	0.7	0.6	0.9	1.1
Serial Memory	M	4.1	6.0	5.7	5.9
(Visual)	SD	1.7	1.5	1.9	2.1
Serial Memory	M	6.3	5.7	5.9	6.8
(Visual-Motor)	SD	1.3	1.5	1.2	1.3
Spelling	M	6.8	7.3	9.9	11.3
	SD	3,8	2.7	5.2	3.3

TABLE XIV (Continued)

		PRE-TEST		POST TEST	
TEST		CONTROLS	LEARNING GAMES	CONTROLS	LEARNING GAMES
Persistence	M	17.3	15.6	17.3	33.1
	SD	6.1	3.9	7.8	32.1
Pattern Recog. (Verbal)	M	2.1	2.8	2.9	5.1
	SD	1.3	1.1	1.6	1.1
Letter Recog. (Verbal)	M	25.3	25.9	25.8	26.0
	SD	1.1	0.3	0.6	0
Letter Recog. (Written)	M	24.9	24.5	25.1	26.0
	SD	1.5	1.1	1.4	0
Letter Recog. (Sequence)	M	21.4	23.6	24.9	26.0
	SD	5.2	2.8	1.9	0
Serial Memory (Auditory)	M	5.1	3.6	6.4	6.1
	SD	0.7	2.4	1.5	1.2
Serial Memory (Visual)	M	5.2	5.3	7.1	6.8
	SD	1.3	2.1	0.9	1.2
Serial Memory (Visual-Motor)	M	6.0	6.5	6.8	7.5
	SD	1.2	1.3	1.5	0.9
Spelling	M	7.1	12.0	13.1	14.6
	SD	1.5	2.4	1.6	2.1

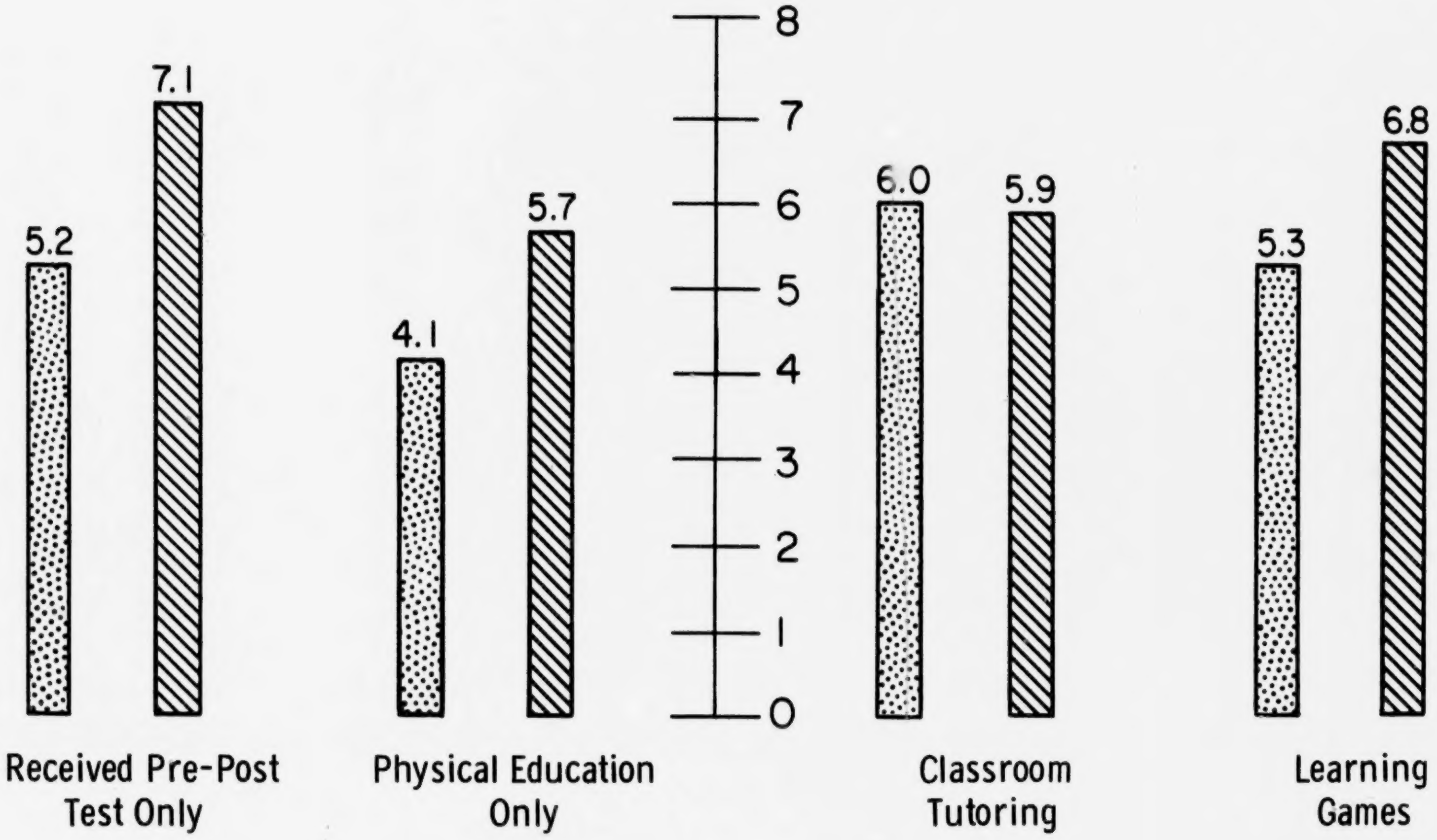
PRE- AND POSTTEST SCORES OF SECOND GRADERS IN ALPHABET SEQUENCE, VERBAL AND MOTOR RESPONSE, BY GROUP

Figure 11



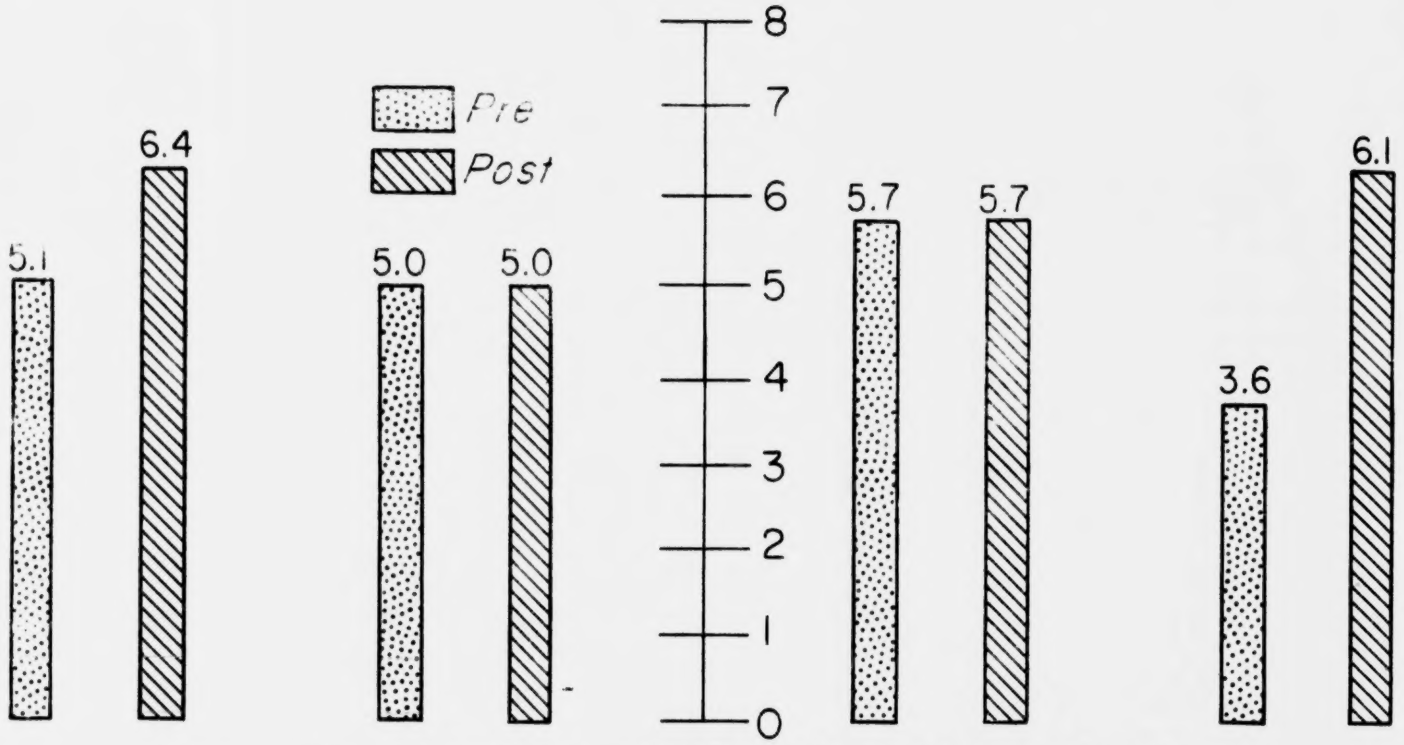
PRE- AND POSTTEST SCORES OF SECOND GRADERS IN SERIAL MEMORY OF LETTERS, VISUAL CUES, BY GROUP

Figure 12



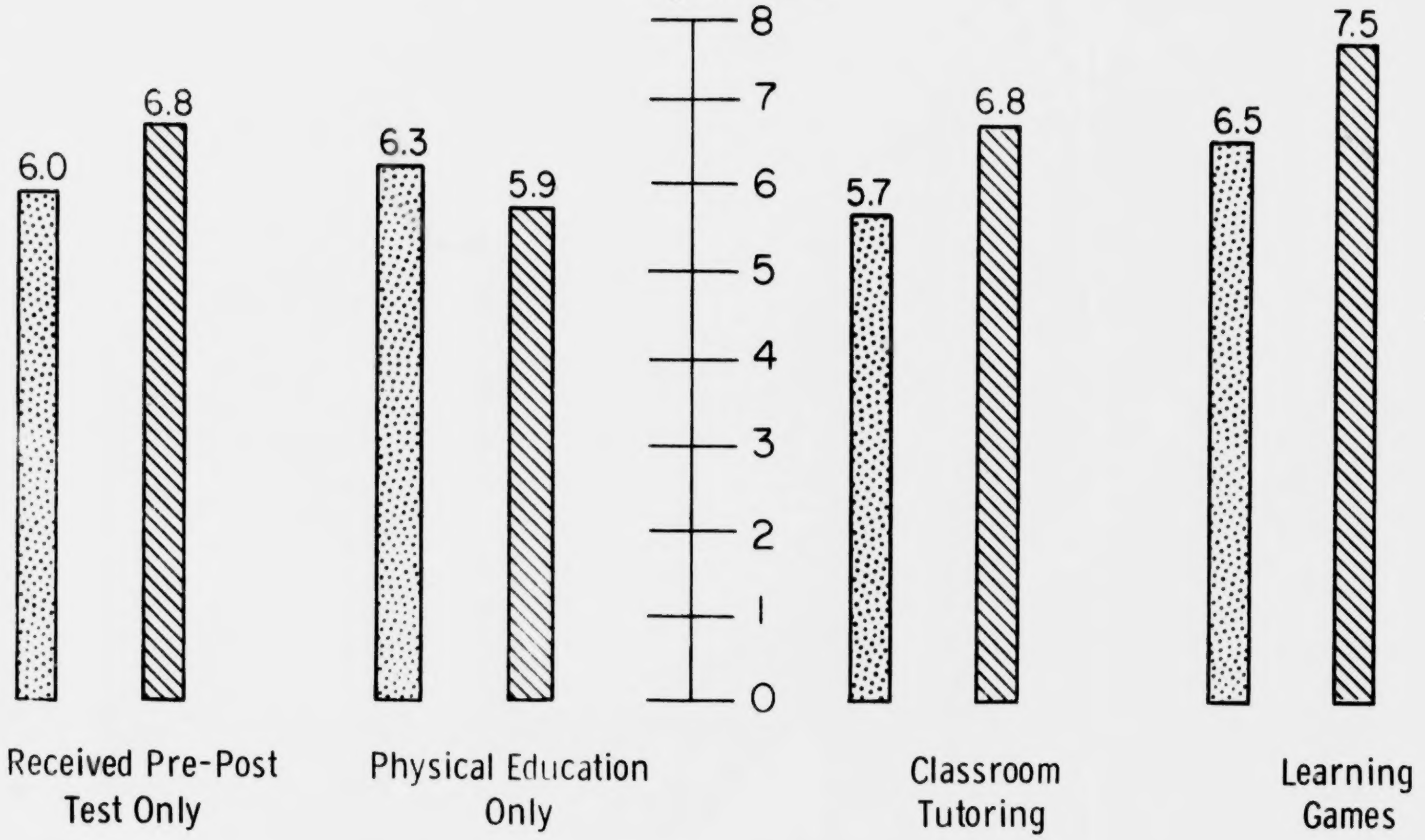
PRE- AND POSTTEST SCORES OF SECOND GRADERS IN SERIAL MEMORY OF NUMBERS, AUDITORY CUES, BY GROUP

Figure 13



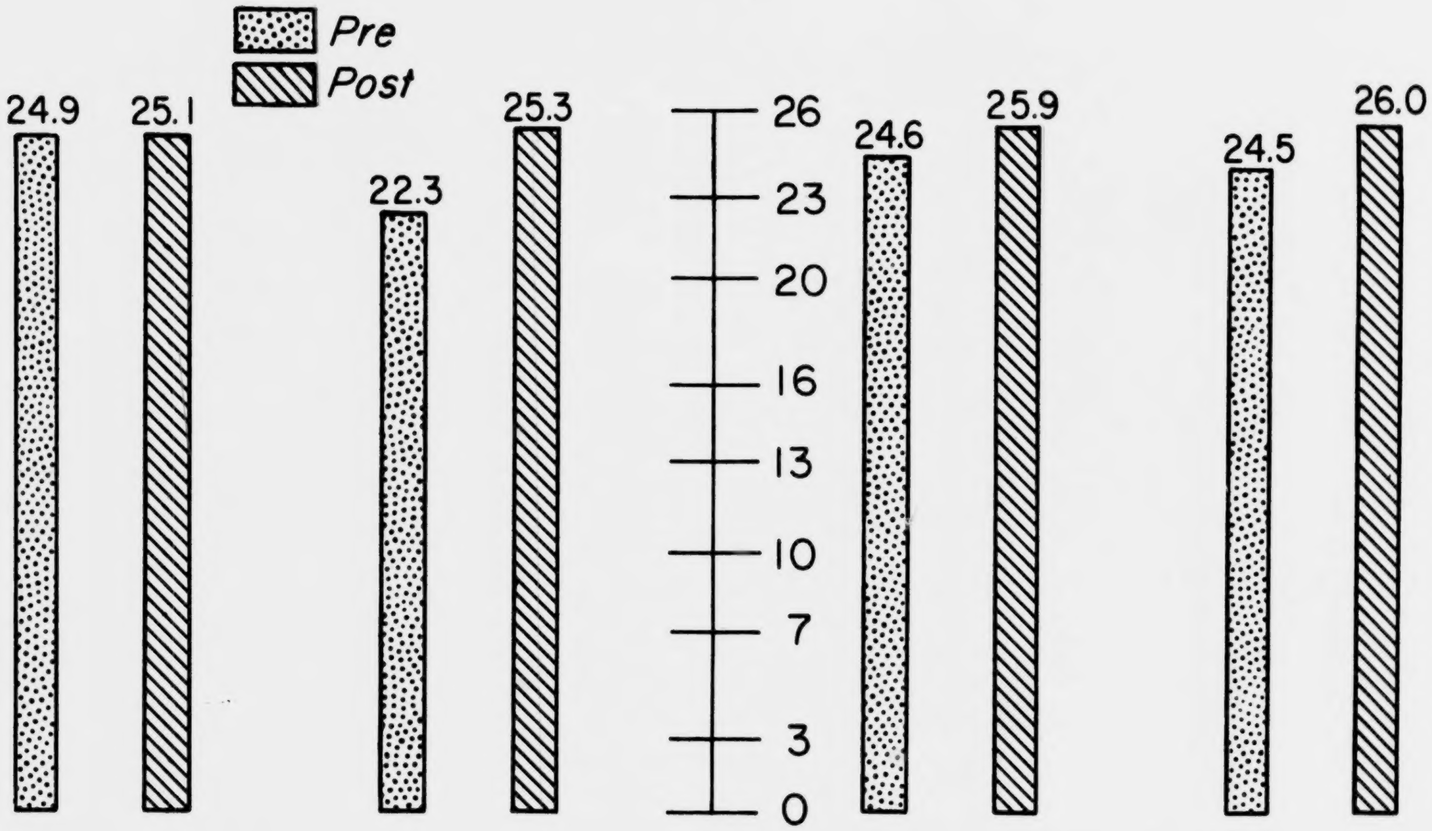
PRE- AND POSTTEST SCORES OF SECOND GRADERS IN SERIAL MEMORY OF ACTIONS, VISUAL CUES, BY GROUP

Figure 14



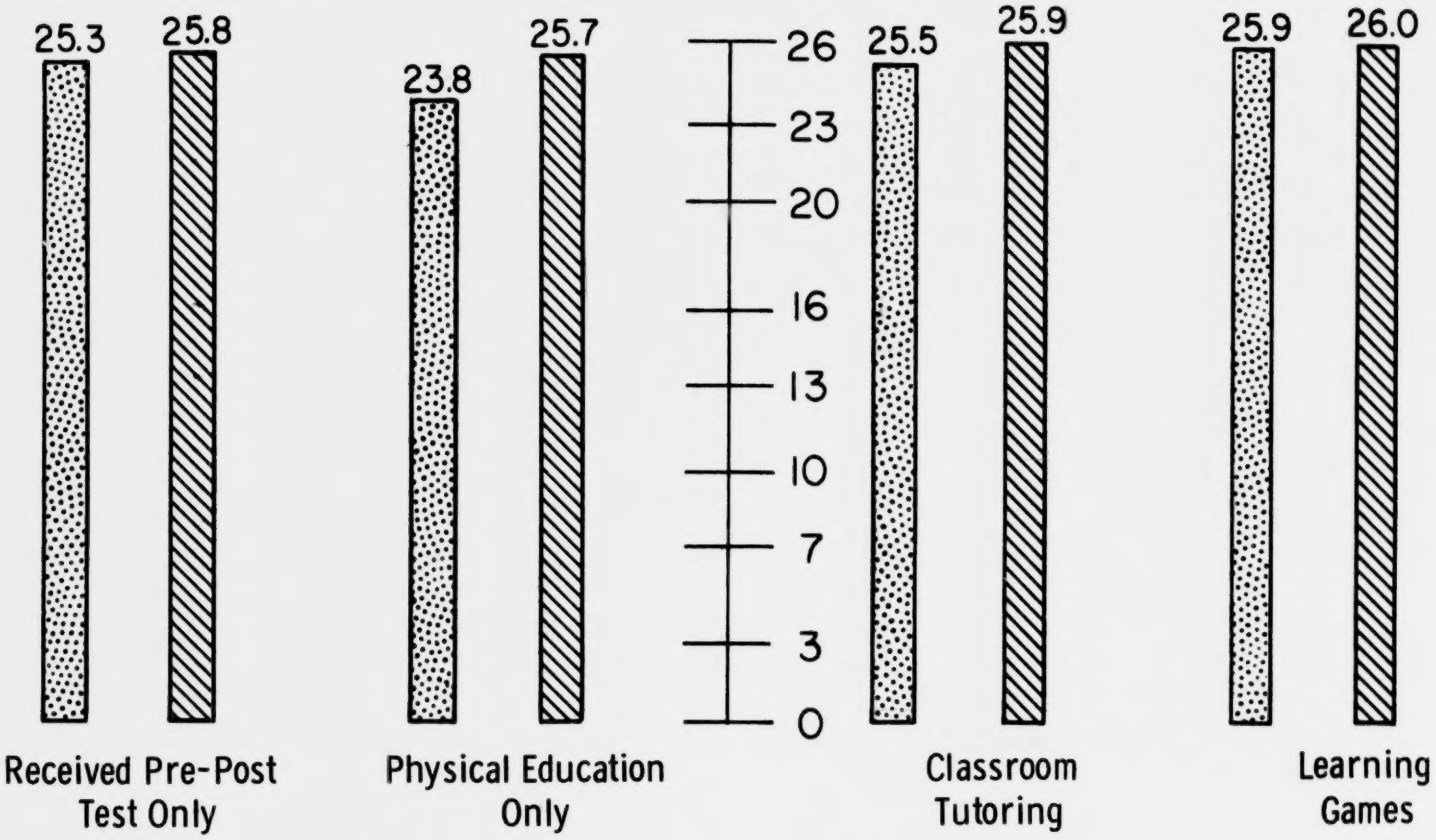
PRE- AND POSTTEST SCORES OF SECOND GRADERS IN LETTER RECOGNITION, WRITTEN RESPONSE, BY GROUP

Figure 15



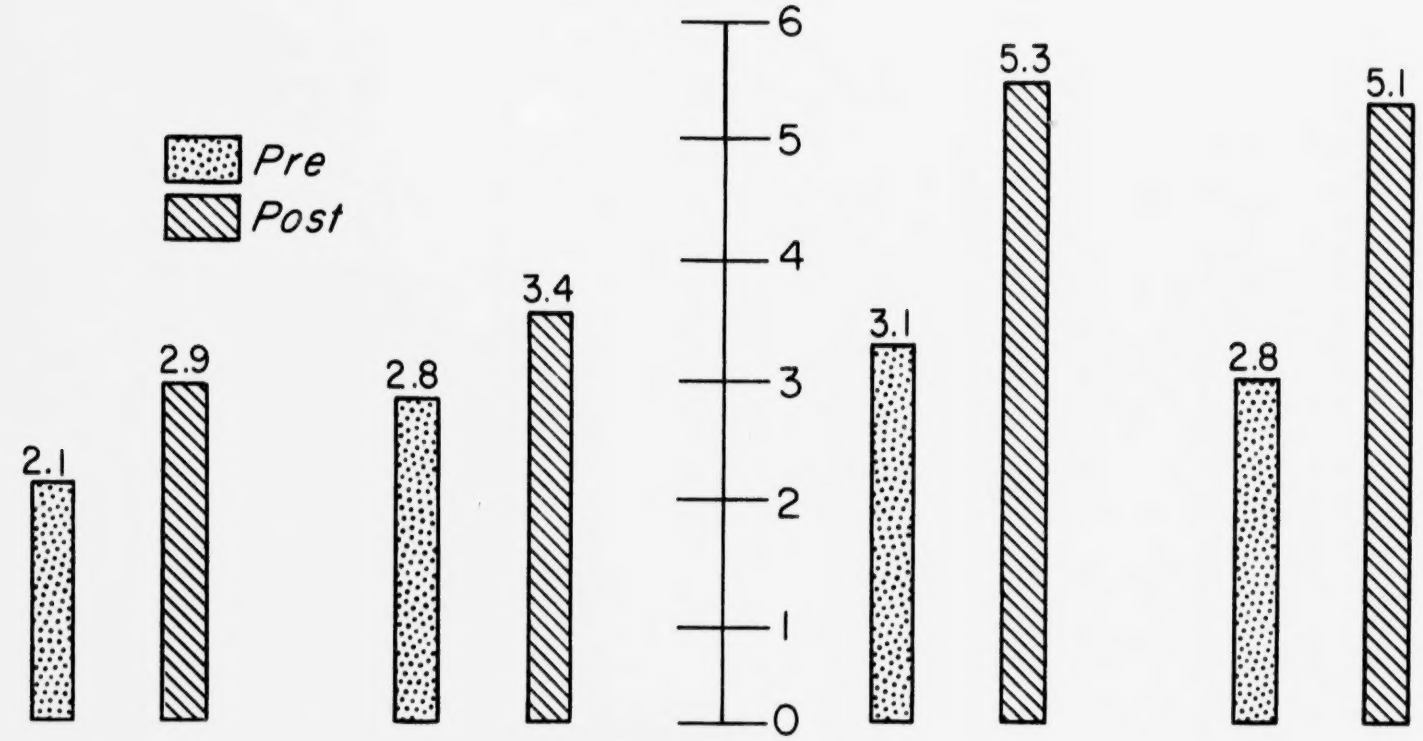
PRE- AND POSTTEST SCORES OF SECOND GRADERS IN LETTER RECOGNITION, VERBAL RESPONSE, BY GROUP

Figure 16



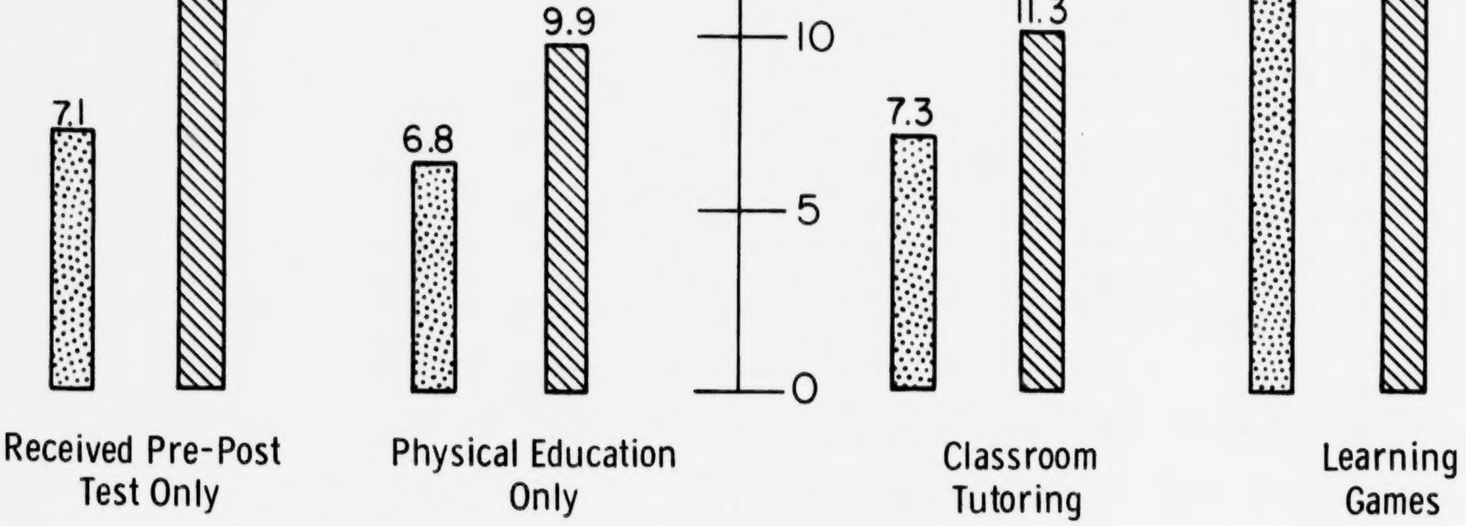
PRE- AND POSTTEST SCORES OF SECOND GRADERS IN PATTERN RECOGNITION, VERBAL RESPONSE, BY GROUP

Figure 17



PRE- AND POSTTEST SCORES OF SECOND GRADERS IN SPELLING, BY GROUP

Figure 18



By the second trend test, the Learning Games and Tutorial Groups contained only one child each who could not at least identify 5 out of 6 of the figures correctly, and in the Learning Games Group, 8 out of 9 posted perfect scores of 6. At the same time, second grade children in the other two groups were not performing well in this task, and only 1 of the children in both the Physical Education Group and in the Control Group could identify 5 out of the 6 figures correctly, with the remainder (15 children) scoring from 0 to 3 correct.

Letter Recognition (Verbal): As can be seen from Table XIV, most of the children in the second grade tested during the pre-test period, could verbally identify all the letters of the alphabet, (means ranging from 23.8 to 25.9). In the final post period, it was found that while all of the second grade children in the Learning Games Group could identify all the letters of the alphabet verbally, there were still two children, one each in the Tutorial Group and in the Control Group, who could not do so. Two children (out of 7) within the group who had physical education, could not identify all the letters verbally.

Letter Recognition (Written): The mean scores initially (Table XV) in this task, range from 22.3 in the Physical Education Group, to 24.9 on the part of the Controls. The task involved first seeing a letter, and then, after the tester removed it, the child had to first name it and then write it.

From inspection of the number of children, by group, who were successful in the final pre-test, in identifying all 26 letters of the alphabet in this manner, it was found that; while all of the 9 children in the Learning Games Group could score perfectly in this test, 1 child in the Tutorial Group and 2 in the Physical Education Group, also 3 in the Control Group, could not do so.

Letter Recognition (Sequence): Naming all the letters of the alphabet in order proved difficult for many children who could otherwise identify them individually when they were presented visually. Inspection of Table XV, however, does reveal initial inter-group differences in the mean scores in this task.

The first means range from 14.3 for the Physical Education Group, to 24.1 for the Learning Games Group. These differences are statistically significant. Most important, however, is the comparison of scores earned by the children in the Learning Games Group to those of the children in the Tutorial Group, during the final testing. As can be seen, the mean scores are not significantly different, i.e. 25.0 to 26.0. It is believed important to note, however, that while all of the children in the Learning Games Group became able to order the letters of the alphabet, there were still 2 in the Physical Education Group, 2 in the Control Group, and 5 in the Classroom Tutoring Group who could not do so.

Serial Memory Scores: As can be seen upon inspection of all three serial memory scores, the inter-group means are not significantly different in either the pre- or post test, although most groups evidence improvement in the various measures.

Inspection of individual scores, however, in the final testing period, also reveals that the number in each of the groups performing perfectly (i.e., 8 points) in the 3 tests, was roughly comparable. Only 3 scores out of 21 in the Physical Education Group were 8, while 11 scores in each of the other groups were 8.

Spelling: As can be seen, the children in the Learning Games Group posted the highest initial mean (12 out of 20 words correct). Thus, as might be expected, they also finished with the highest mean score of 14.6 out of 20 correct.

There are significant differences also between the initial scores of the Learning Games Group and the Tutorial Group, with the latter significantly lower initially and finishing with a lower mean. More thorough analysis of what happens to the spelling score of the poorest spellers might be further enlightening to second grade teachers interested in this type of program.

Summary of Data from Second Graders.

Special training in pattern recognition whether in a classroom or in a learning game situation, elicited significant changes in this type of score, improvement exceeding that shown by the other groups.

Letter recognition proficiency on the part of the poorer achievers in all groups improved, but perfect scores were elicited from all the second graders in the Learning Games Group, while the other groups contained from 1 to 3 youngsters who still did not know all the letters of the alphabet, either in sequence, or via a written and/or verbal response.

The serial memory scores and those in spelling were roughly equivalent among the various groups, and no significant distinction can be made between the groups, due to the small samples involved, and the fact that the initial mean scores for each group were not equal.

THIRD AND FOURTH GRADES

The data collected from both the third and fourth graders has been presented together. The groups in both of these two grades are small. At the same time, the data analyzed will contain only those test scores collected within the two trend tests, numbering six in all.

As can be seen upon consulting Table XV, in four out of the six tests, the Learning Games Group started higher than the other three groups, (body perception, pattern recognition [verbal], letter recognition [verbal, written and in sequence], and in serial memory [visual-motor]). Inspection of the final scores reveals that the Learning Games Group was superior in 5 out of 6 and in the sixth test, serial memory (visual-motor), they were ranked second to the third and fourth graders in the Controls.

Further analysis of the data on Table XV revealed that while the Learning Games Group finished higher than did the other groups in the test of letter recognition in alphabetical sequence, 25.56 out of 26, as compared to 24.97 for the Physical Education Group, the difference was not significant (t=1.78) as there were so few subjects in each of the groups compared.

Inspection, however, of the percentage of third and fourth graders, by group, who could identify all 26 letters of the alphabet, via writing, reciting them in order, and verbally identifying them, revealed that 87% of the children in the Learning Games Group recorded perfect scores in the tests of both verbal and written identification of the letters, while only 58% to 70% of the children within the other groups could perform perfectly in these two tests (Table XVI). The same superiority was seen in the scores of the children (third and fourth graders), when inter-group comparisons are made of the final success achieved in the test of verbally reciting the alphabet in correct sequence (Table XVI).

TABLE XV

SCORES OF THIRD AND FOURTH GRADE, BY GROUP, IN SELECTED TESTS GIVEN DURING PRE- AND POST TESTING PERIODS

A. PHYSICAL EDUCATION GROUP (N=13)

TEST	PRE-TEST		POST TEST	
	Mean	S.D.	Mean	S.D.
Body Perception	7.692	2.127	8.846	1.232
Persistence	20.307	6.294	56.471	24.127
Pattern Recognition (Verbal)	2.923	1.439	4.153	1.010
Letter Recognition (Written)	22.769	2.807	25.000	1.414
Letter Recognition (Sequence)	21.307	6.890	24.076	2.794
Serial Memory (Visual-Motor)	5.692	1.856	6.083	1.257

B. CONTROL GROUP (N=12)

TEST	PRE-TEST		POST TEST	
	Mean	S.D.	Mean	S.D.
Body Perception	6.833	1.864	8.500	2.020
Persistence	21.500	6.982	29.166	13.892
Pattern Recognition (Verbal)	2.666	0.626	3.500	0.866
Letter Recognition (Written)	20.583	5.124	25.416	0.781
Letter Recognition (Sequence)	22.083	5.545	22.250	6.796
Serial Memory (Visual-Motor)	4.250	1.233	7.090	1.447

TABLE XVI (Continued)

C. TUTORING GROUP (N=8)

TEST	PRE-TEST		POST TEST	
	Mean	S.D.	Mean	S.D.
Body Perception	7.375	2.057	8.000	1.414
Persistence	26.625	9.911	33.750	13.754
Pattern Recognition (Verbal)	3.500	0.866	5.375	0.484
Letter Recognition (Written)	24.875	1.166	24.750	1.089
Letter Recognition (Sequence)	23.250	5.825	23.625	2.057
Serial Memory (Visual-Motor)	5.500	1.414	5.875	2.521

D. LEARNING GAMES GROUP (N=16)

TEST	PRE-TEST		POST TEST	
	Mean	S.D.	Mean	S.D.
Body Perception	8.250	1.952	9.000	1.369
Persistence	17.000	6.041	68.187	63.765
Pattern Recognition (Verbal)	3.625	0.857	5.562	0.614
Letter Recognition (Written)	25.312	0.994	25.875	0.331
Letter Recognition (Sequence)	24.687	2.826	25.562	0.878
Serial Memory (Visual-Motor)	5.250	1.714	6.500	1.369

TABLE XVI

PERCENTAGE OF THIRD AND FOURTH GRADERS, BY GROUP, WHO ACHIEVED PERFECT SCORES (i.e. 26) IN THE 3 LETTER RECOGNITION TESTS IN THE FINAL TESTING PERIOD

GROUPS	LEARNING GAMES (N=16)	TUTORING (N=8)	CONTROLS (N=12)	PHYSICAL EDUCATION (N=13)
Tests				
Letter Recognition (Verbal)	87%	66%	79%	50%
Letter Recognition (Written)	87%	58%	50%	57%
Letter Recognition (Sequence)	81%	66%	40%	43%

A more thorough analysis of the six tests, by group, during the trend tests and by the four groups in the study, is found on Table XVII which follows. Essentially it can be seen that the Learning Games Group was superior in letter recognition via the written modality,by the first trend test (25.75), when compared to the other groups, and this difference was statistically significant (t=2.79) when compared to the mean of the Physical Education Group in this same test, during the first trend testing (mean = 24.69).

By the time the second trend tests were given, the Learning Games Group was superior in the measures of self-control used (persistence), compared to the means posted by the other three groups: Learning Games Mean = 75.8 seconds, while that of the Tutorial Group was only 42.5 seconds, difference significant at the 1% level (t=2.92). Overall, however, it can be seen that the Learning Games Group scored better in most of the tests given than did the third and fourth grade students in the other three groups, a fact which makes analysis of improvement rather difficult. For example, the Learning Games Group means were superior to the other groups' averages in 18 out of the 24 test scores, as seen in Table XVII. At the same time, the Learning Games Group maintained their superiority during the post tests and posted better final scores in five out of the six tests given.

Summary: Although many of the differences were not statistically significant (using a t test) due to the small number of subjects and to the large distribution of the scores, the Learning Games Group, based on the percentage of children scoring perfectly, performed better in the tests of letter recognition. In measures of self-control (persistence), the Learning Games Group, composed of third and fourth graders, was also superior. Significant differences were seen in these measures by the time the second trend test was given, when the average of the Learning Games Group was contrasted to those of the other three groups.

TABLE XVII

MEANS AND STANDARD DEVIATIONS, BY GROUP, FOR THIRD AND FOURTH GRADE CHILDREN, COMBINED, IN THE PRE- AND POST TESTS AND IN THE TWO TREND TESTS

A. PHYSICAL EDUCATION GROUP (N=13)

Tests	Pre-Test		1st Trend		2nd Trend		Post Test	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Body Perception	7.692	2.127	8.384	1.277	8.692	1.204	8.846	1.232
Persistence	20.307	6.294	23.538	10.768	31.307	16.203	56.461	24.127
Pattern Rec. (Verbal)	2.923	1.439	3.923	0.917	4.461	0.845	4.153	1.101
Letter Rec. (Written)	22.769	2.807	24.692	1.270	24.769	1.764	25.000	1.414
Letter Rec. (Sequence)	21.307	6.890	23.615	3.411	22.615	3.456	24.076	2.794
Serial Mem. (Vis.-Motor)	5.692	1.856	6.304	2.559	6.846	1.406	6.083	1.257

B. CONTROL GROUP (N=12)

Tests	Pre-Test		1st Trend		2nd Trend		Post Test	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Body Percp.	6.833	1.864	8.916	1.849	8.000	2.272	8.500	2.020
Persistence	21.500	6.982	25.583	11.162	30.583	10.704	29.166	13.892
Pattern Rec. (Verbal)	2.666	0.626	3.333	0.851	3.333	0.944	3.500	0.866
Letter Rec. (Written)	20.583	5.124	24.333	2.017	25.583	0.962	25.416	0.781
Letter Rec. (Sequence)	22.083	5.545	22.250	6.917	22.500	5.315	22.250	6.796
Serial Mem. (Vis.-Motor)	4.250	1.233	6.166	1.465	6.250	1.689	7.090	1.447

TABLE XVII (Continued)

C. TUTORING GROUP (N=8)

	Pre-Test		1st Trend		2nd Trend		Post Test	
Tests	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Body Perception	7.375	2.057	7.875	2.088	9.000	1.224	8.000	1.414
Persistence	26.625	9.911	45.562	15.344	42.500	10.392	33.750	13.754
Pattern Rec. (Verbal)	3.500	0.866	4.750	0.661	5.125	0.600	5.375	0.484
Letter Rec. (Written)	24.875	1.166	22.625	2.825	24.500	2.000	24.750	1.089
Letter Rec. (Sequence)	23.250	5.825	24.125	2.976	24.875	1.900	23.625	2.057
Serial Mem. (Visual-Motor)	5.500	1.414	5.625	2.496	5.500	1.658	5.875	2.521

D. LEARNING GAMES GROUP (N=16)

	Pre-Test		1st Trend		2nd Trend		Post Test	
Tests	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Body Perception	8.250	1.952	9.375	1.363	9.187	1.018	9.000	1.369
Persistence	17.000	6.041	29.500	17.414	75.812	38.002	68.187	63.765
Pattern Rec. (Verbal)	3.625	0.857	4.875	0.857	5.562	0.791	5.562	0.614
Letter Rec. (Written)	25.312	0.994	25.750	0.433	25.812	0.421	25.875	0.331
Letter Rec. (Sequence)	24.687	2.826	25.437	0.947	25.625	0.600	25.562	0.878
Serial Mem. (Visual-Motor)	5.250	1.714	5.375	1.727	6.812	1.591	6.500	1.369

SEX DIFFERENCES

Four of the tests were analyzed to determine whether there were any apparent sex differences in the improvement and in the final scores achieved. These tests included; pattern recognition (verbal), letter recognition (written), serial memory (visual), and spelling. It might be hypothesized, for example, that the active methods inherent in the learning games program may appeal more to boys than to girls. The data which follows was surveyed in order to explore that assumption.

Inspection of Tables XVIII and XIX suggests that initially sex differences, by group, were negligible. Although the girls in the Learning Games Group were better than the boys, 24.1 to 22.8, the difference was not statistically significant (t=1.44). The sex differences in spelling within the same group were also not significant. In both the Control Group and in the Tutorial Group, however, the spelling scores of the girls, initially, were significantly superior to those of the boys in the same test.

Although, as can be seen on Tables XVIII and XIX, both boys and girls achieved significant improvement in the tests, when pre- and post test results are compared, the final differences between the sexes are not significant.

TABLE XVIII

COMPARISON OF GIRLS' SCORES, BY GROUP, IN SELECTED PRE- AND POST TESTS

	PHYSICAL EDUCATION				CONTROLS				TUTORING				LEARNING GAMES			
	Pre-		Post		Pre-		Post		Pre-		Post		Pre-		Post	
Test	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Pattern Rec. (Verbal)	2.0	1.9	3.0	1.8	2.4	1.6	3.1	1.3	2.6	0.8	5.0	1.1	3.4	1.0	5.2	1.0
t scores	t=5.21				t=4.64				t=22.02				t=18.00			
Letter Rec. (Verbal)	17.4	10.0	22.5	7.0	20.4	8.8	25.5	1.0	20.4	6.7	25.4	0.9	24.1	3.9	25.9	0.2
t scores	t=6.43				t=4.87				t=6.83				t=3.56			
Letter Rec. (Written)	17.2	10.4	21.7	8.9	19.9	9.1	25.2	1.5	18.8	7.4	25.2	0.9	22.6	5.4	25.8	0.4
t scores	t=5.50				t=5.12				t=7.31				t=5.80			
Serial Mem. (Visual)	4.0	3.0	5.4	2.5	4.0	2.2	6.7	2.0	3.8	1.6	6.4	1.8	5.2	2.2	6.4	1.5
t scores	t=4.93				t=12.62				t=14.77				t=5.80			
Spelling	7.7	5.1	10.9	7.0	8.4	6.1	10.7	6.0	7.1	4.7	9.7	4.5	9.7	6.4	13.5	4.7
	t=4.91				t=4.60				t=5.59				t=8.39			

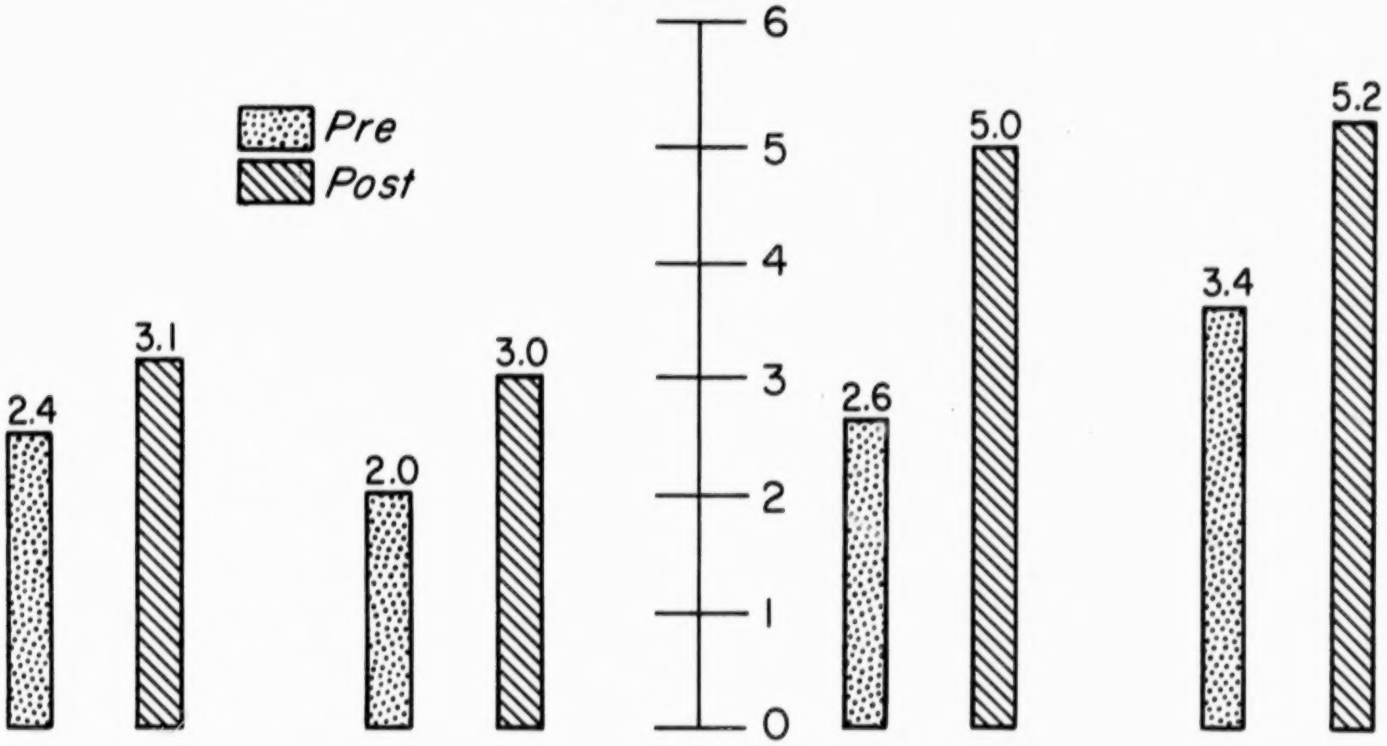
TABLE XIX

COMPARISON OF BOYS' SCORES, BY GROUP, IN SELECTED PRE- AND POST TESTS

	PHYSICAL EDUCATION				CONTROLS				TUTORIAL				LEARNING GAMES			
	Pre-		Post		Pre-		Post		Pre-		Post		Pre-		Post	
Test	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Pattern Rec. (Verbal)	2.9	.9	3.5	1.2	2.6	1.3	3.2	1.2	3.2	1.3	5.6	0.6	2.9	1.0	5.3	1.1
t scores		t=4.9				t=4.47				t=17.9				t=3.78		
Letter Rec. (Verbal)	18.3	8.3	23.3	3.9	22.2	5.6	25.5	.9	18.9	8.7	25.6	0.8	22.8	5.7	25.8	0.5
t scores		t=6.73				t=5.14				t=6.36				t=4.33		
Letter Rec. (Written)	17.3	8.8	23.3	3.7	20.7	6.8	24.6	1.2	17.1	8.8	25.0	1.4	22.7	5.0	25.9	0.2
t scores		t=7.37				t=5.08				t=7.85				t=4.93		
Serial Mem. (Visual)	4.0	2.1	5.1	2.4	4.3	1.8	5.9	2.2	4.5	2.5	5.2	2.3	4.4	1.9	6.2	1.4
t scores		t=4.78				t=7.73				t=9.01				t=10.11		
Spelling	6.7	5.9	8.6	6.4	6.8	5.1	10.7	4.7	5.0	4.5	9.4	4.8	11.2	6.3	14.6	4.6
t scores		t=3.03				t=7.85				t=9.65				t=5.79		

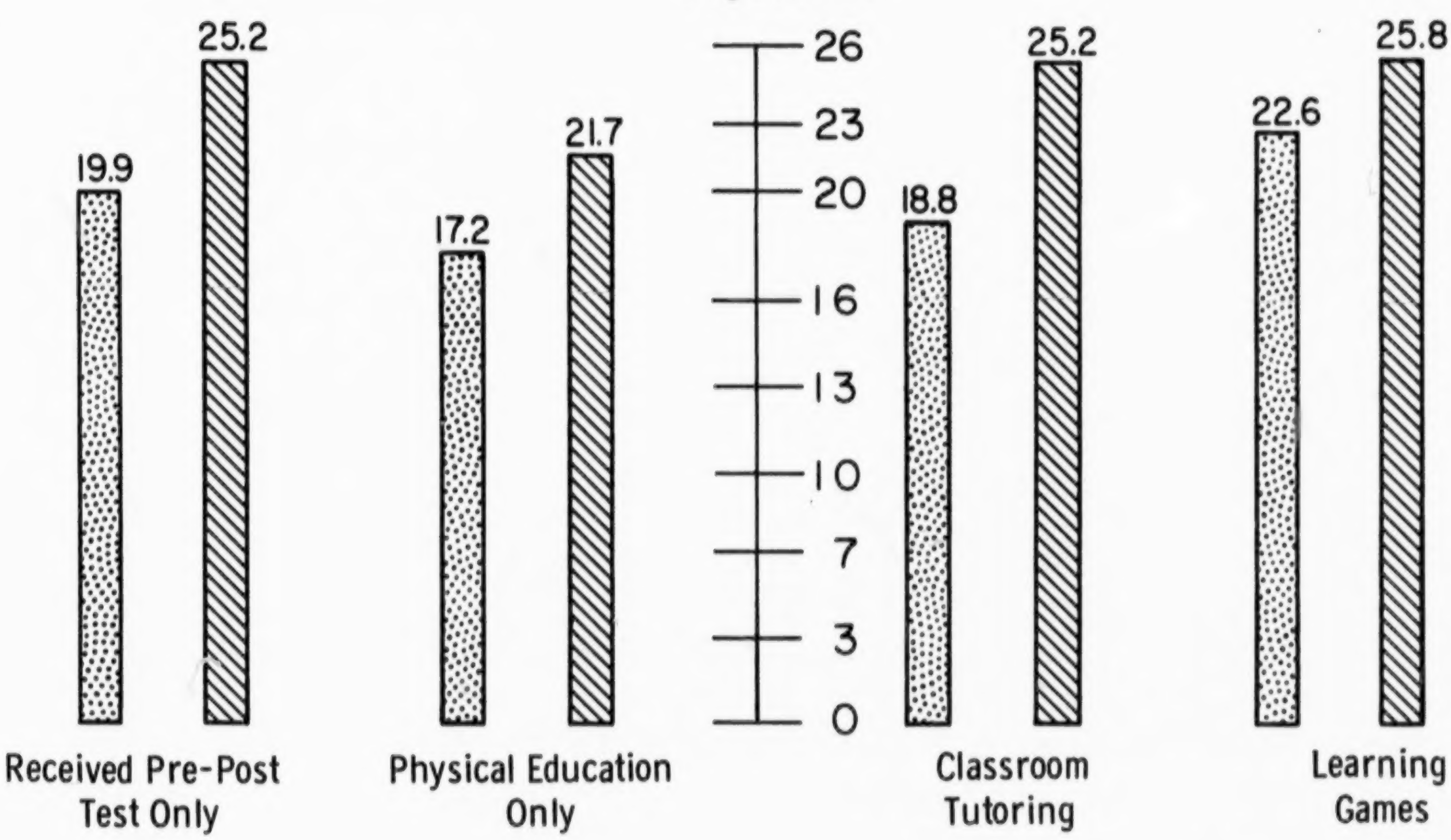
PRE- AND POSTTEST SCORES OF ALL GIRLS IN PATTERN RECOGNITION, VERBAL RESPONSE, BY GROUP

Figure 19



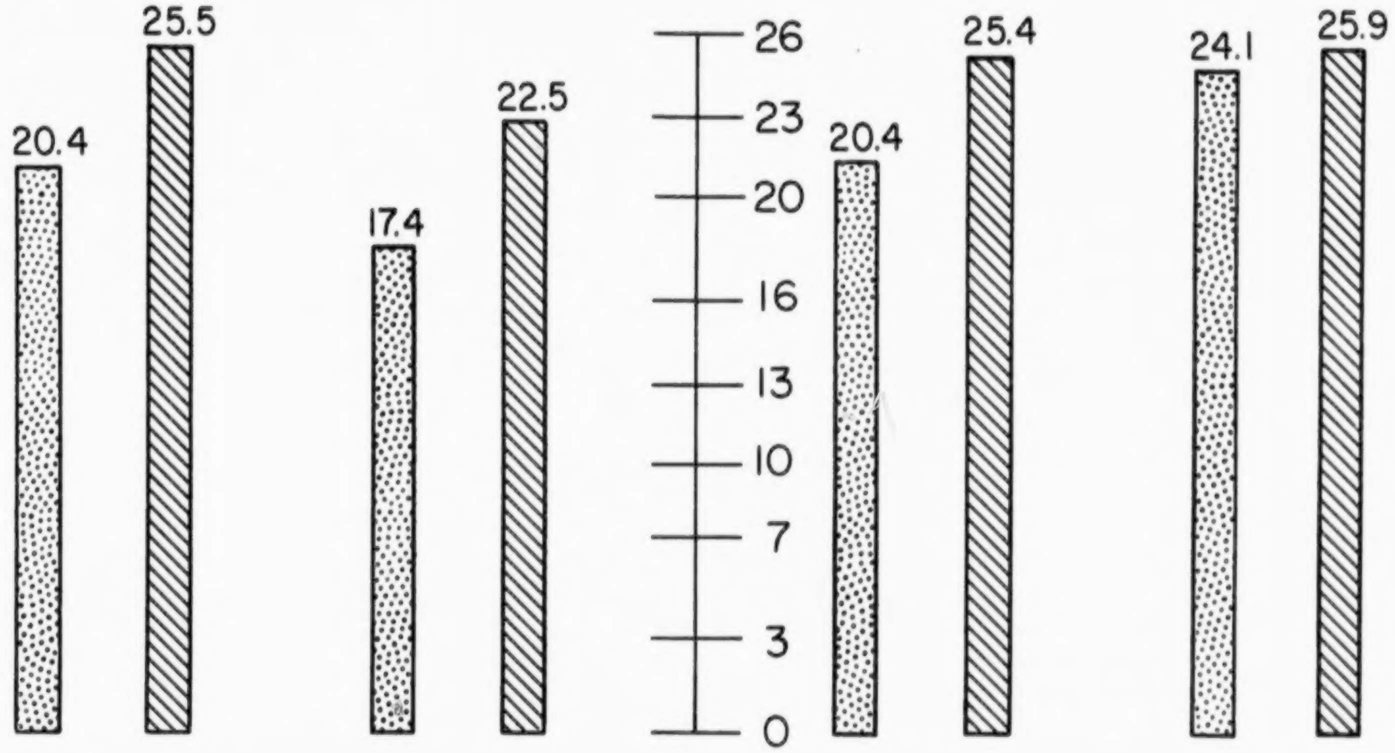
PRE- AND POSTTEST SCORES OF ALL GIRLS IN LETTER RECOGNITION, WRITTEN RESPONSE, BY GROUP

Figure 20



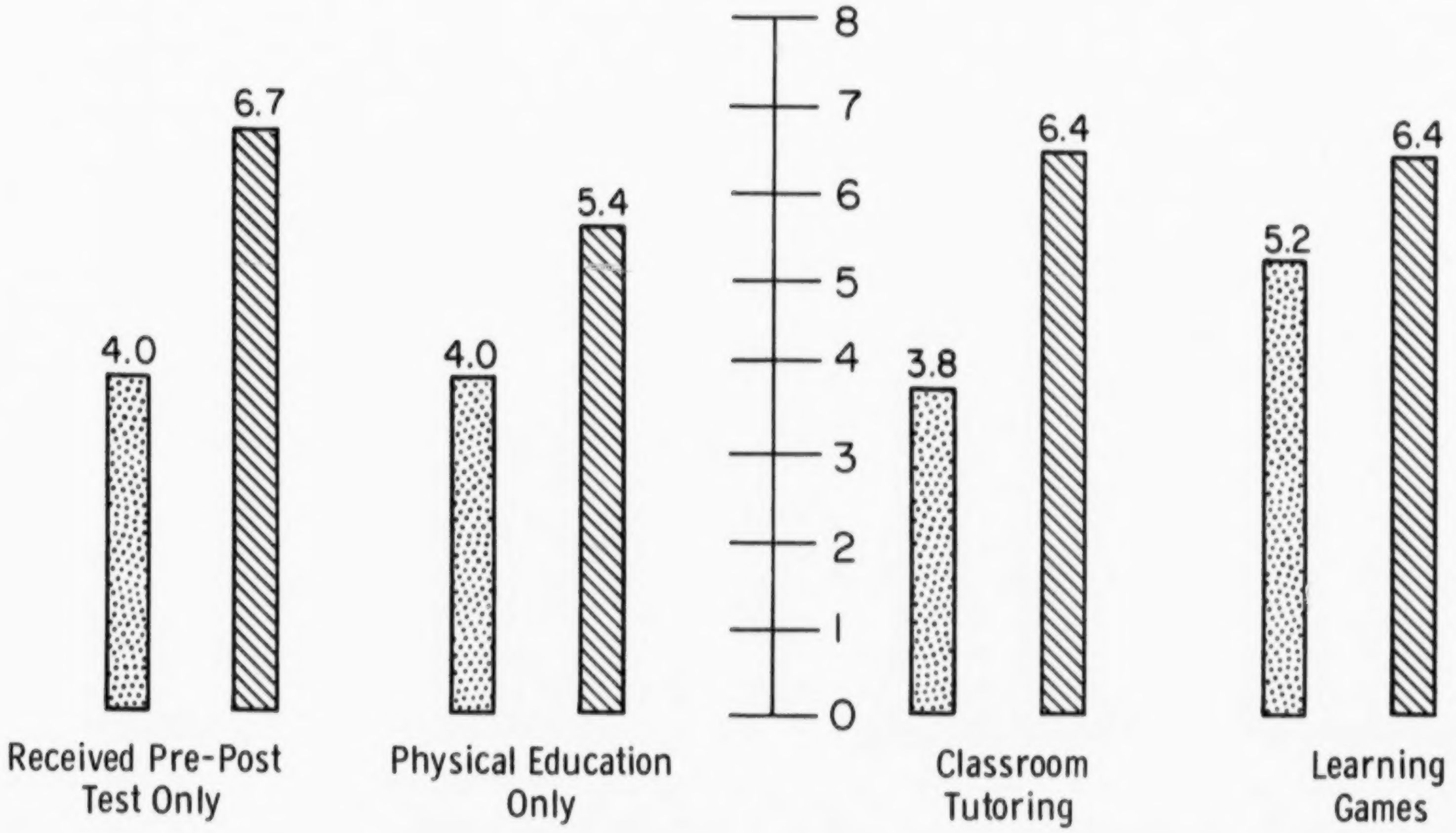
PRE- AND POSTTEST SCORES OF ALL GIRLS IN
LETTER RECOGNITION, VERBAL RESPONSE, BY GROUP

Figure 21



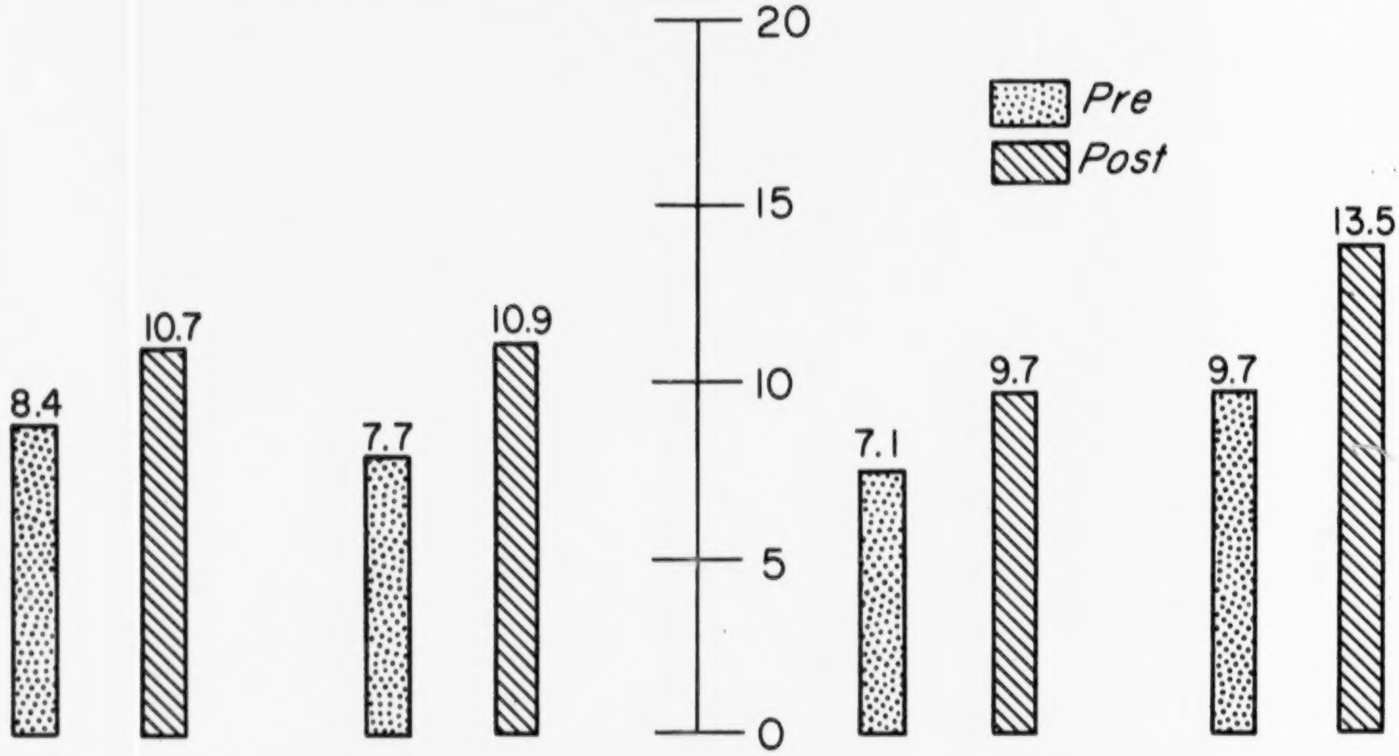
PRE- AND POSTTEST SCORES OF ALL GIRLS IN
SERIAL MEMORY OF LETTERS, VISUAL CUES, BY GROUP

Figure 22



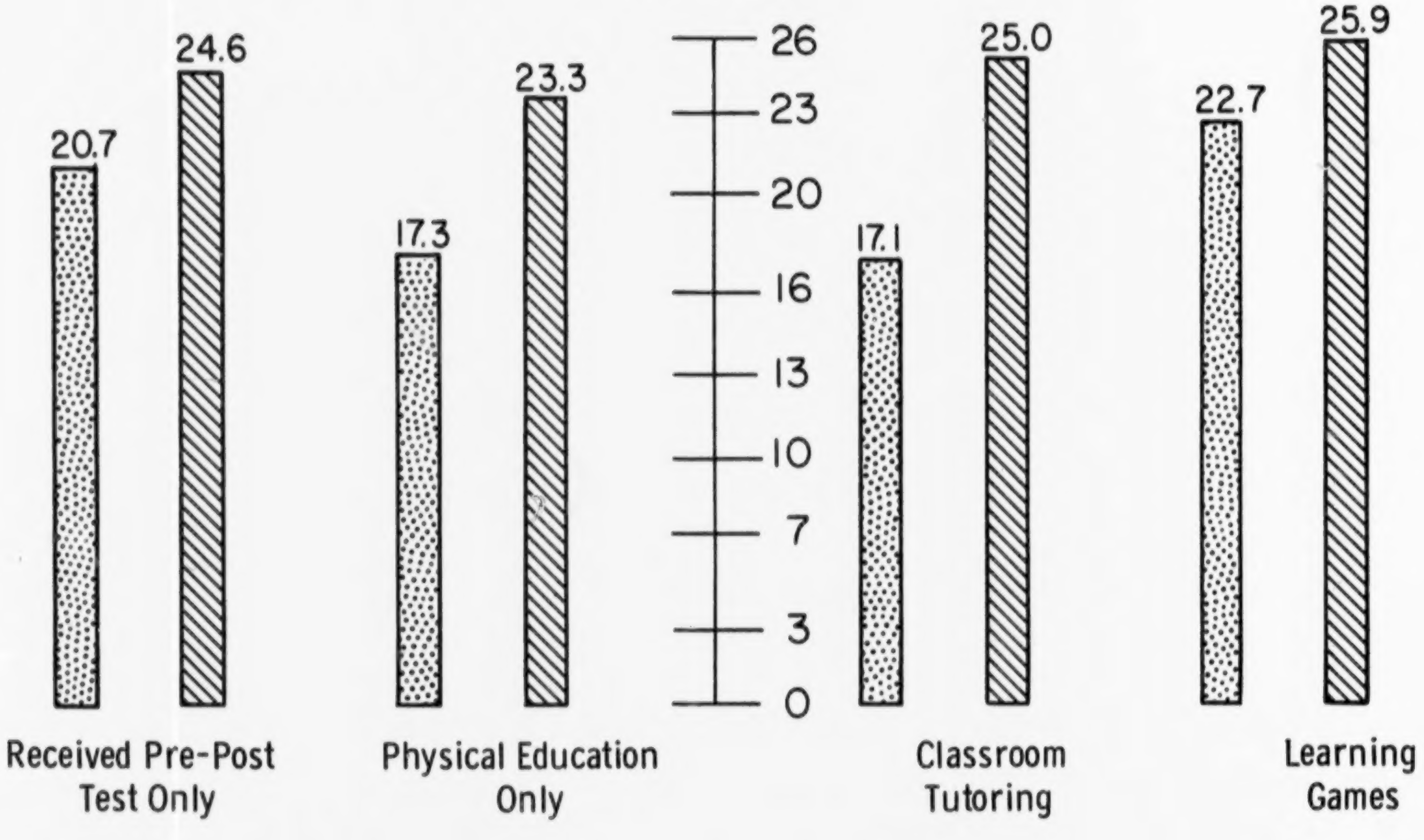
PRE- AND POSTTEST SCORES OF ALL GIRLS IN IN SPELLING, BY GROUP

Figure 23



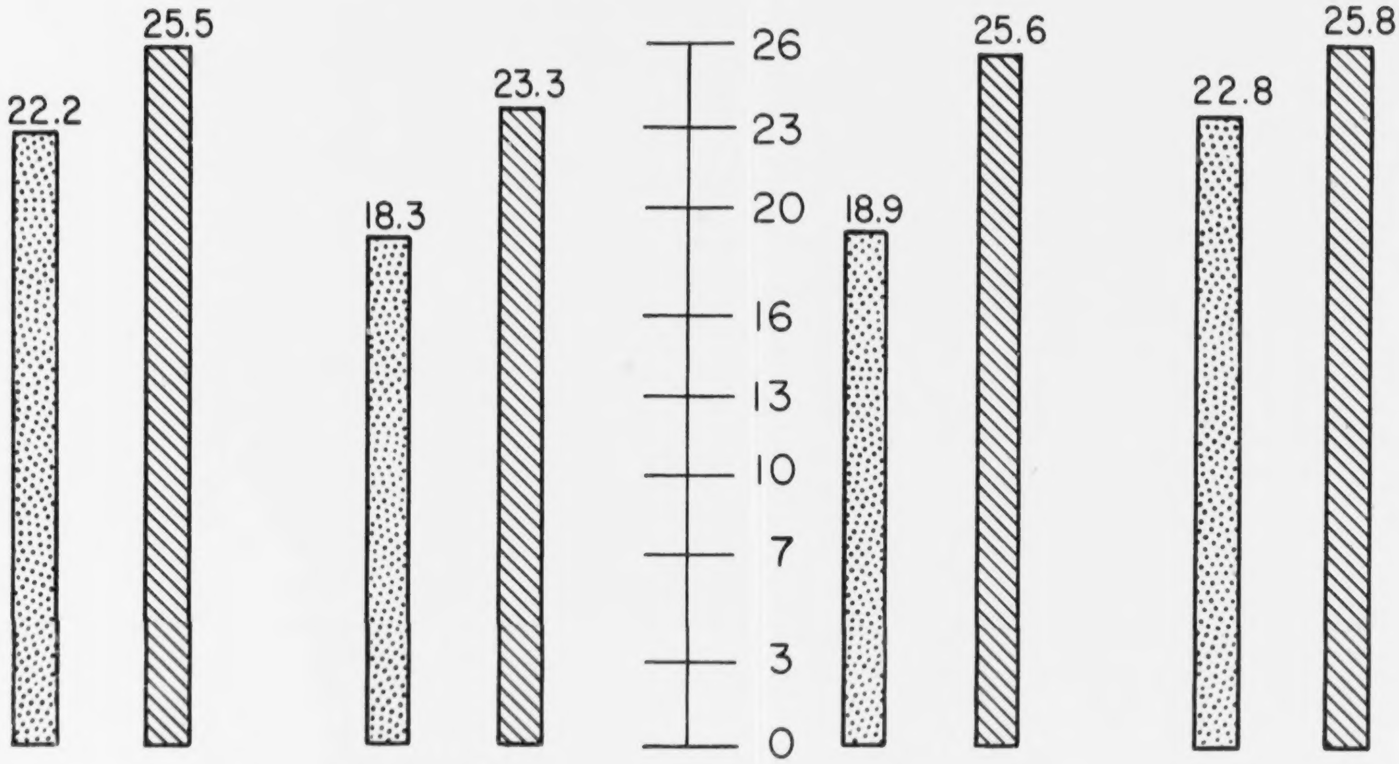
PRE- AND POSTTEST SCORES OF ALL BOYS IN LETTER RECOGNITION, WRITTEN RESPONSE, BY GROUP

Figure 24



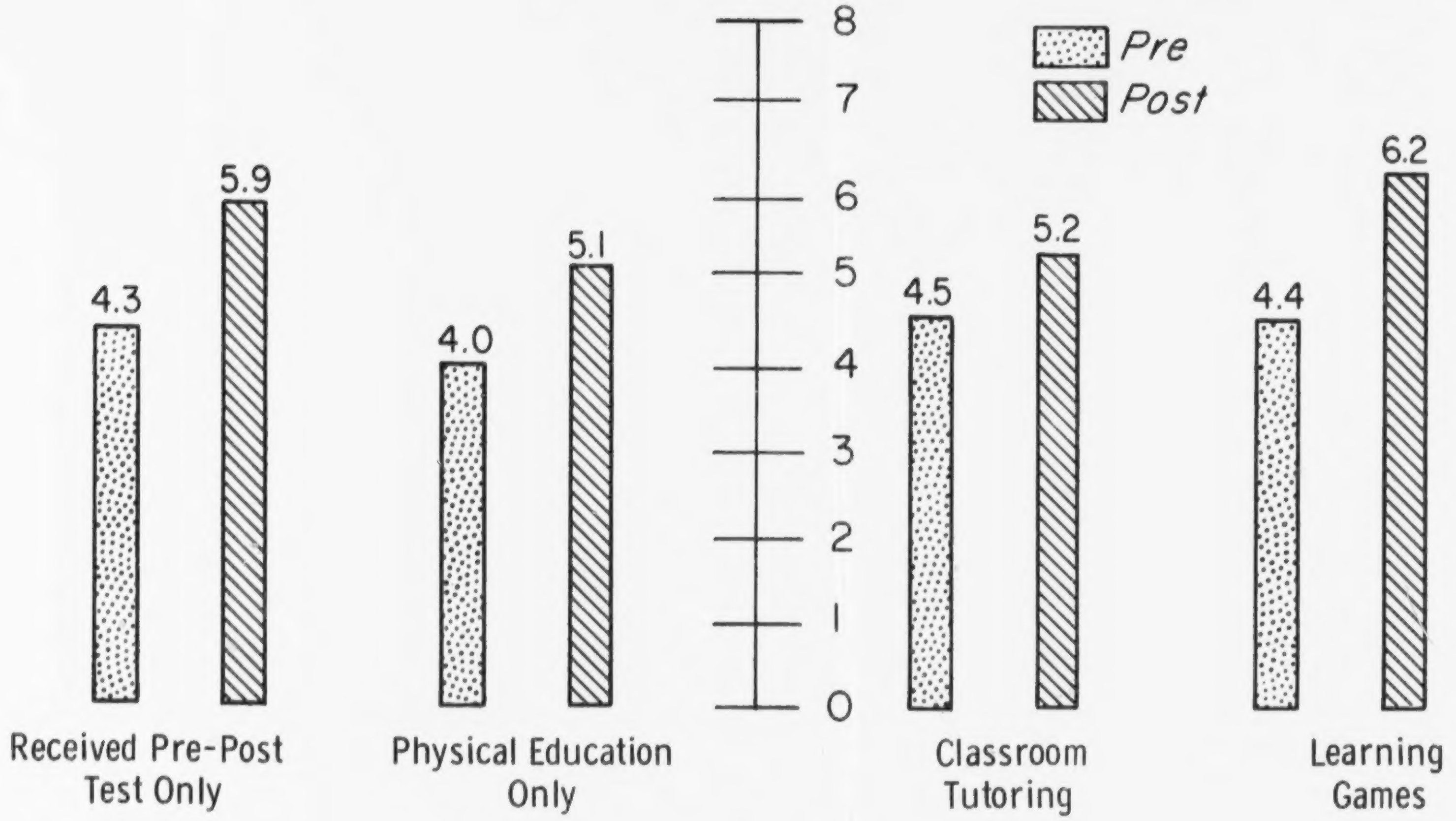
PRE- AND POSTTEST SCORES OF ALL BOYS IN
LETTER RECOGNITION, VERBAL RESPONSE, BY GROUP

Figure 25



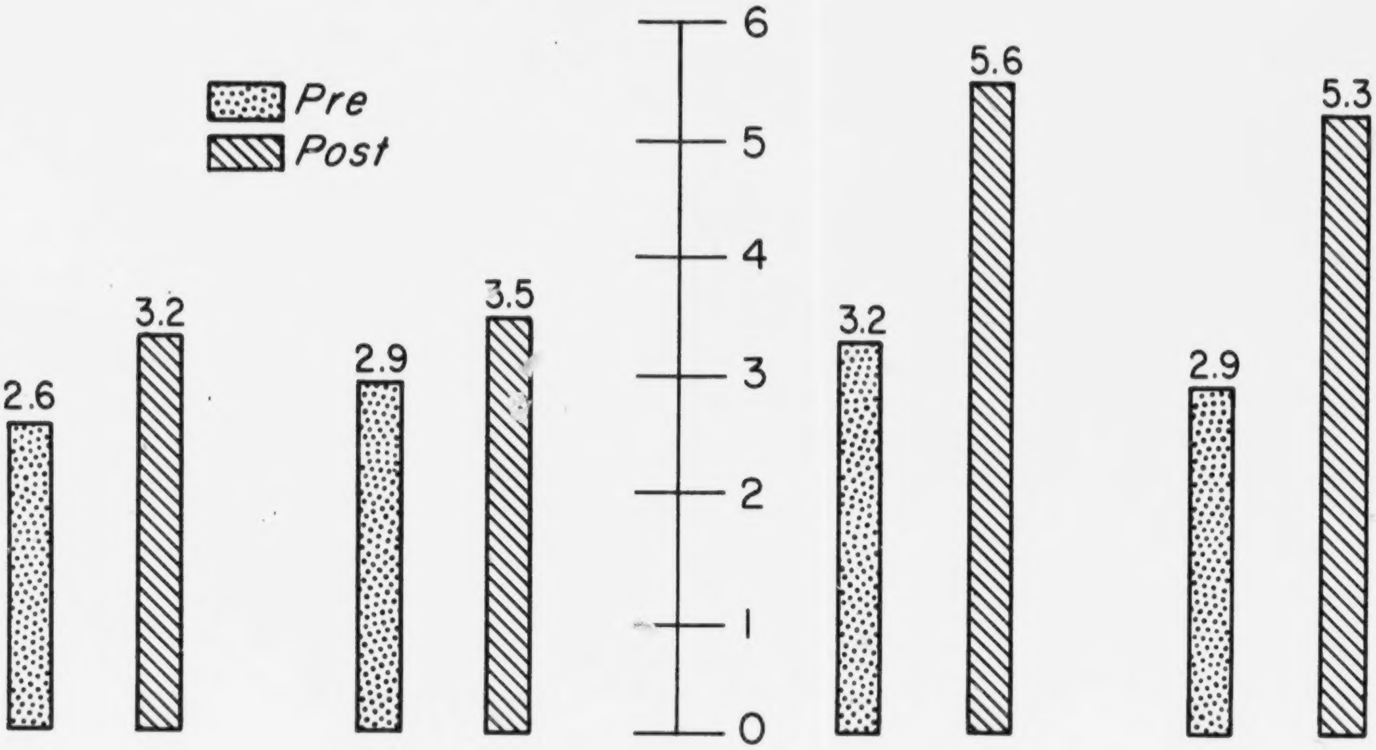
PRE- AND POSTTEST SCORES OF ALL BOYS IN
SERIAL MEMORY OF LETTERS, VISUAL CUES, BY GROUP

Figure 26



PRE- AND POSTTEST SCORES OF ALL BOYS IN PATTERN RECOGNITION, VERBAL RESPONSE, BY GROUP

Figure 27



PRE- AND POSTTEST SCORES OF ALL BOYS IN SPELLING, BY GROUP

Figure 28

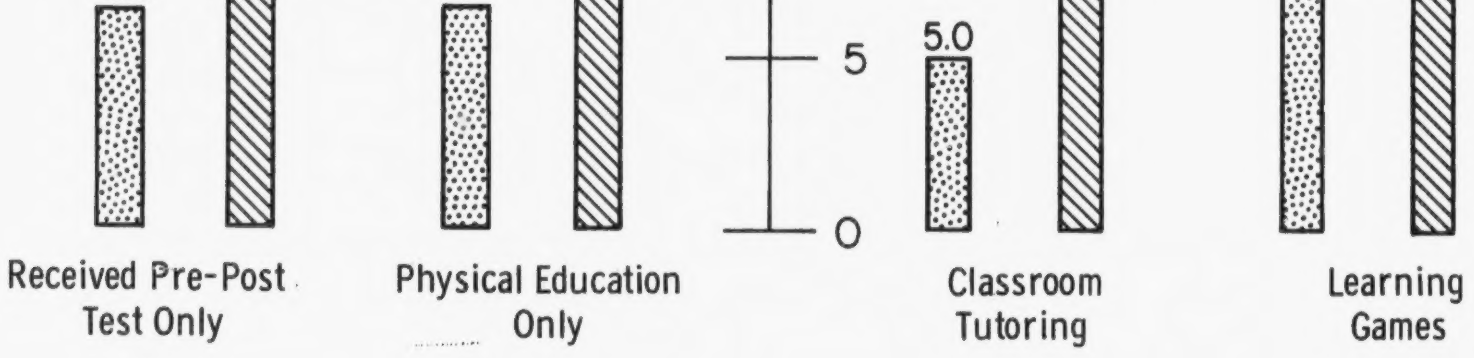


TABLE XX

COMPARISON OF PRE- AND POST TEST SCORES IN THE PEABODY PICTURE VOCABULARY TEST OF I.Q., BY GROUP

GROUPS	PRE-TEST		POST TEST	
	MEAN	S.D.	MEAN	S.D.
PHYSICAL EDUCATION (N=26)	85.08	19.23	84.35	12.91
CONTROL GROUP (N=29)	80.69	24.16	84.48	14.31
TUTORING GROUP (N=31)	92.03	15.63	91.52	17.60
LEARNING GAMES GROUP (N=35)	92.88	13.71	89.74	11.68

As can be seen, two groups, the Tutorial Group and the Learning Games Group, were significantly higher initially in the I.Q. scores they posted. There was a significant difference for example, between the initial I.Q. scores posted by the Learning Games Group and the Physical Education and Control Groups (t=2.37) for the former comparison. At the same time the terminal I.Q. tests differed between groups; however, these differences were not significant statistically at the 5% level (t=1.74) between highest terminal score (91.52 posted by Tutorial Group) and the lowest terminal score (84.35 by the Physical Education Group).

At the same time, although the general shift from the pre- to the post test scores was upward, these differences were not statistically significant. For example, the t score, when comparing the greatest differences between the pre- and post test I.Q. scores of the Controls, was only 1.31.

THE LOWEST ACHIEVERS

Many teachers and parents reading research reports are not usually pleased by the fact that the researcher seems to deal in groups rather than with individuals. Perhaps conditioned by the laws of probability learned in statistics classes, most report writers do not pause to look at a single child and see how he progressed as the result of some kind of experimental program.

In an attempt to rectify the type of oversight described above, the following paragraphs will contain surveys of how the children scoring poorly initially in the pre-tests given during the two weeks prior to the start of the experimental program, progressed during the semester. Initially an analysis of the poorest 10 scores in each of 4 tests will be carried out. Next, the poorest 3 scorers in selected tests within the pre-test battery will be traced through the two trend tests, and at the post test. And finally, the poorest scorer on each of several tests, will be similarly analyzed.

It is hoped that in this way, the teacher who says to herself when reading most educational materials, "Yes, but what about Johnny in the back of the room, who is causing me all the trouble (or no trouble because he does nothing)... What about him?", will in some way be pacified and repaid for the industry needed to "plough through" a report as extensive as this one.

The Poorest 10.

Pattern Recognition (Verbal): As can be seen upon inspection of previous pages, children in the two groups in which pattern recognition was part of the lesson, evidenced significant improvement from pre- to post tests, while those in the other two groups did not.

The initial means on the part of some of the groups are striking (.8 and 1.0 out of 8), while the final means on the part of the Learning Games and Tutorial Groups reflect significant improvement from means of 2.0 to 5.0 and 5.1.

Letter Recognition (Written): The initial means for the various groups ranged from 5.2 to 16.9 out of a possible score of 26. The final means, while registering improvement, do not show significant differences between the means achieved by the Tutorial and Learning Games Groups. At the same time, two of the children in the Physical Education Group could not write any letters of the alphabet, while three more could write only 13, 18, and 19. The 10 scores in the Tutorial Group ranged from (one subject), to 23 (3) and 24 (6). The Controls' data collected in the post testing, also indicated that one child could only identify and write 5 letters of the alphabet, while one could write only 20, with the remainder posting scores

TABLE XXI

CHILDREN POSTING LOWEST 10 SCORES FROM EACH SCHOOL IN TESTS LISTED

		PRE-TEST				POST TEST			
		PHYSICAL EDUC.	CONTROL	TUTORING	LEARNING GAMES	PHYSICAL EDUC.	CONTROL	TUTORING	LEARNING GAMES
Pattern Recog. (Verbal)	M	0.8	1.0	1.6	2.0	2.0	2.7	5.1	5.0
	SD	0.9	.8	0.7	0.6	1.5	0.8	0.7	1.2
Letter Recog. (Verbal)	M	6.8	12.7	8.7	18.1	18.7	24.9	25.1	25.8
	SD	6.9	8.4	5.1	6.4	7.9	1.4	0.9	0.4
Letter Recog. (Written)	M	5.2	10.7	6.2	16.9	17.3	24.0	24.4	25.8
	SD	5.9	8.3	2.7	5.7	9.4	1.5	1.6	0.4
Serial Mem. (Visual)	M	1.4	1.9	1.9	2.4	4.6	5.7	5.5	6.1
	SD	1.2	1.6	1.4	1.3	3.2	2.3	2.2	1.4

of 23 and 24. In contrast, all the 10 "lowest scorers" in the Learning Games Group, had scores of 24 and 25 out of 26 letters of the alphabet.

Letter Recognition (Verbal): In the pre- and post test means reflecting the accuracy of verbal responses to visually presented letters, it is apparent that all groups improved significantly, and that at the final testing, there were no significant differences between at least three of the groups (control, tutoring, and learning games) while the fourth (physical education) had a mean score of 18.7.

The final mean score for this latter group, was depressed by the fact that four of the children posted final scores of 4, 7, 11, and 18 letters correct out of a possible 26. The final scores in the other three groups were similar.

Serial Memory (Visual): Again, comparison of pre- to post test means indicates improvement on the part of all groups, with most improvement evidenced on the part of the children in the Learning Games Group. However, final inter-group differences are not statistically significant,due to the small number of subjects in these sub-categories.

THREE LOWEST SCORING SUBJECTS IN SELECTED TESTS, BY GROUP.

The scores from three children doing poorest in their initial attempts in each of five tests, were analyzed. Four tests used for this analysis included persistence, pattern recognition (verbal), letter recognition (written), and spelling.

Persistence: The three children moving fastest from each group were surveyed, and their progress through the trend testing and at the final post test, was surveyed. In general, the poorest groups of three initially were in the Tutorial Group (mean = 7.3 seconds), the Physical Education Group (mean = 6 seconds) and in the Learning Games Group (mean = 7.6 seconds). The three poorest performers in the Control Group had a mean of 9.3 seconds, when asked to walk a 12' line as slowly as they could.

By the final post test, the triads in all four groups' average scores were about 20 seconds (range from 20 seconds in the Tutorial Group, to 22.3 second mean from the three children in the Learning Games Group). The three children in the Learning Games Group however, evidenced greater initial improvement in self-control by the first trend test (mean= 20 seconds, as compared to means of 11 seconds in the Physical Education Group and 6 seconds in the Tutorial Group, by this point in the semester). At the same time, the Learning Games trio (3 lowest scoring children) posted a mean score of 43 seconds when the second trend test was given, as contrasted to other means of 19 seconds for the Controls, 8 seconds for the Physical Education Group and 8.3 seconds for the Tutorial Groups.[5]

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[5] It is possible that the general speeding-up in this type of test seen in the final post test scores of the Learning Games children, was due to the fact that they became bored with playing "slow down" games, and with the various administrations of the "slow down" test!

The child exhibiting the poorest self-control initially in the Control Group was a first grade girl who walked the line in 8 seconds. At this point in the testing, she could name no letters of the alphabet in any of the three letter recognition tests given her. By the end of the semester, she could name all but three letters of the alphabet and had a persistence score of 35 seconds.

A first grade boy in the Physical Education Group had an initial persistence score of 6 seconds, and could name only four letters of the alphabet in the tests given initially. By the end of the testing period his persistence score was 38 seconds however, he still could identify less than one-half of the letters of the alphabet when they were shown to him.

The poorest initial persistence score in the Tutorial Group was by a first grade boy (6 seconds). He could at this point identify only 3 or 4 letters of the alphabet. By the end of the semester his persistence score was 20 seconds and he could identify from 20 to 25 letters of the alphabet.

A first grade boy in the Learning Games Group also posted an initial persistence score of 6 seconds. His score in the first trend test was 13 seconds, in the second trend test it was 60 seconds, and finally a score of 29 was scored. Initially he could identify only from 8 to 9 letters of the alphabet, while at the conclusion of the semester he achieved a score of 25 in each of the letter recognition tests given.

Pattern Recognition (Verbal): In the verbal identification of patterns, all four groups had at least three children in them who initially could identify verbally only one or none of the 6 geometric figures presented to them. The three children who in the Control Group initially could identify none of the figures but could identify one-half of them in the final test, all achieved a score of 3; the second group (Physical Education) was given no special help in pattern recognition. Again the final scores were 0, 2, and 1 out of a possible 6.

In the two groups, the Tutorial Group and the Learning Games Group, the final scores of the three lowest initial performers were considerably higher. In the Tutorial Group, two of these children had a score of 5, while one scored 4 right out of 6 attempts. The final scores for the children in the Learning Games Group were 5, 6, and 2. The first grade boy scoring only 2 in the final testing session had an I.Q. of 97 and could write and say all the letters of the alphabet and given them in correct order.

Letter Recognition (Written): The lowest 3 scorers in this test within each of the four groups were, in all cases, first graders. Two children in the Control Group and all three in the Physical Education Group could not identify any of the letters of the alphabet during the first week of the first grade. The lowest scoring children in the other two groups performed only a little better. (The initial scores were 3.2 and 3 out of 26 in the Tutorial Group; and 8.9. and 11 in the

Learning Games Group.)

By the time the first trend test was given, six weeks into the semester, as would be expected, the Learning Games Group scored highest,(whether because they had a head start or whether it was due to the learning games is, of course, impossible to determine). In any case, the mean scores at this point in the semester, based upon the scores from the lowest 3 children in each group were; 3.3 letters for the Controls, 4.6 letters for the Physical Education Group, 11.3 letters correct for the Tutorial Group, and 20 letters correct for the Learning Games Group (a mean score which none of the other three groups would reach until the final testing session, 12 weeks later).

The second trend test produced mean scores on the part of the three children surveyed in each group of: Controls= 17.5, Physical Education Group=15.5, Tutorial Group=19.5, and the Learning Games Group =25.0.

The final testing resulted in the following means, by group: Controls 22.3, Physical Education 21.5, Tutorial Group 23.3, and Learning Games Group scored a mean of 25.66 (scores of 26,26, and 25).

Spelling: Initially three of the groups, based upon the scores of the three poorest spellers in the second grade, had means of from 4.3 to 5.3 words correct out of 20, (5.3 for the Controls, 5.0 for the Physical Education Group, and 4.3 for the Tutorial Group). The Learning Games Group of three posted an initial mean of 9 words correct (scores of 9. 9 and 9).

Thus the groups did not start at the same point. Indeed, the starting mean of the Learning Games Group was higher than the final mean score posted by two of the other three groups. (Final mean of the Physical Education Group was 7, and that t

The final scores for the 3 poorest spellers in the Controls Group, who had a starting mean of 5.3,were 12.0 words correct out of 20, which compared favorably with the final mean of the three children in the Learning Games Group who had a mean of 12.6. Thus no clear-cut superiority can be claimed for one method of teaching these three poorest spellers in the four groups, as contrasted to another method. The average improvement in the Control Group was higher (6 words) than for the children in the Learning Games Group (average of only 3 words improvement). It must be remembered however, that no specific practice was given the children in the special programs for the words contained on the list.

Analysis of the poorest single spellers will not be carried out because the trend tests did not contain the spelling test.

Summary of the Change in the Children Scoring Poorest in Selected Tests.

Analysis of the data in which the three poorest initial scorers in various tests were inspected, revealed that:

In the test of persistence, the children in the Learning Games Group evidenced marked superiority by the 12th week, over the scores of the 3 children in the other 3 groups. (43 seconds as contrasted to less than 20 seconds for the other three groups). In the test of pattern recognition, via a verbal response, the children in the Learning Games Group and in the Classroom Tutoring Group, evidenced more improvement and greater final performance, about 5 correct out of 6, than did the children in the two groups in which pattern recognition was not an integral part (about 3 out of 6 correct).

Although the Learning Games Group of three children who did poorly in their initial test of letter recognition was superior to the other three groups, their improvement was also more rapid and their final scores higher than those of the children in the other three groups. By the 12th week, for example, the three children in the Learning Games Group posted a mean of 25 correct out of 26, while the children in the other groups had mean scores ranging downward from 19.5 to 15.5.

The Learning Games Group of three second graders finished higher than the other groups, but at the same time, their starting mean was also higher (9 out of 20, as contrasted to means of from 4.3 to 5.3 for the other groups). However, the mean scores for the Controls (12.0) was similar to that of the children in the Learning Games Group (12.6)

SUMMARY OF THE FINDINGS

1. The Learning Games Group improved more and posted significantly higher final scores in the tests of motor ability, including those evaluating balance and agility.
2. A significantly larger percentage of the children in the Learning Games Group, in all grades, learned all the letters of the alphabet earlier in the semester than did the children in the other three groups.
3. The children in the Learning Games Group exhibited significantly greater self-control by the 12th week than did the children in the other three groups.
4. The children in the Tutorial Group, and those in the Learning Games Group improved more and posted higher final scores in the test involving the verbal identification of six common geometric figures, than did the children in the other two groups.
5. The children in the Learning Games Group had significantly higher final scores in spelling than did the children within the other three groups however, the Learning Games Group posted a higher initial mean in this test.
6. The children in the Learning Games Group evidenced significantly higher final scores in two serial memory tasks involving the auditory recognition and verbal recitation of number sequences and remembering the correct order

of pictures presented visually.

7. The children in the Learning Games Group posted significantly higher final scores in all grades in the tests involving the ability to correctly recite the letters of the alphabet in the correct order.
8. There were no marked sex differences in the data analyzed.
9. The children scoring lowest (i.e. lowest three in each test, by group), within the Learning Games Group in various measures of letter recognition, posted higher final scores and at the same time showed more marked improvement than did those in the other groups by the first trend test (after six weeks of the program).

CHAPTER V

DISCUSSION OF THE FINDINGS

GENERAL IMPLICATIONS

The completion of an investigation of this nature is often accompanied by several phenomena, and indeed these were present in this study. For example, there is usually a gnawing uncertainty on the part of the investigators at the termination, of whether they were able to adequately control the multitude of variables which may have influenced the results more than those imposed by the experimenters themselves. Secondly, it usually becomes apparent that some of the evaluative tools were less than appropriate to the purposes of the study. The completion of a program of the type described on these pages, also may result in a realization on the part of the investigators that the problem area dealt with was in truth, more complex than originally realized. Examples of these conundrums within the context of this investigation are discussed within the following paragraphs.

A number of variables impinged upon the study, many of which were not controlled, or poorly controlled by the investigators. For example, shortly after the beginning of the study, and after the initial testing took place, all of the eight second graders who purportedly were going to have nothing "extra done to them", were suddenly exposed to a five-day-a-week special program of small-group tutoring during which time, many of the academic operations intrinsic to the study were practiced.

A second most important set of variables out of the control of the investigators, revolved around the quality of the classroom instruction to which the children in the various groups were exposed during the investigation. In truth, the various learning methodologies and the physical education, impinged upon only about 10 - 15% of the total time the students spent in school each week. Thus it is highly probable that what occurred during the other 85 - 90% of the time, could have influenced the test scores collected within the two trend tests and during the final testing period, more than did the events which took place under the ageis of the instructors we provided. Thus the apparent indication that the active learning games did, in the case of some academic operations, seem to accelerate learning, seems rather remarkable.

Other types of variables which undoubtedly influence an investigation of the type described on these pages, are: the quality of personal interactions between the teachers and students[1]; the fluctuations in weather; differences in facilities in which the teaching occurs as well as the general "tone" of approval, support, or censure of the program which the children may have "picked up" via either subtle or obvious cues emanating from their classroom teachers.

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[1] Although the fact that two teachers dropped out half-way through the program because of health problems occurred, this factor was controlled in part. A different teacher worked with each of the two "teaching" groups (the Tutorial Group and the Learning Games Group).

Several of the tests given, proved less than adequate for the purposes of the investigation. Among these was the Peabody Picture Vocabulary Test. It was apparent that skewed scores were being elicited from the children whose cultural background precluded their knowledge of the existence of some of the items shown to them in the test. At the same time, some of the "correct" names demanded by the scoring sheet (i.e. "weiner" instead of hot dog) were inappropriate to the sub-culture being tested. This problem has been written about by numerous authors during the past ten years, and hopefully this rhetoric will eventually result in truly appropriate tests for evaluating the intellect and potential of children within the Black and Mexican-American sub-cultures.

It might also be questioned whether the authors of this report have fallen back into the purportedly antiquated position of testing and attempting to enhance "general faculties" when administering tests of serial memory ability, i.e. attempting to train some general quality via a single task. Justification for our approach, however, was received from inspecting reasonably high and positive correlations we derived upon contrasting various tests of serial memory given during the pilot study phase of the project. Further support for our position was forthcoming, when at the completion of the study, as was demonstrated, apparent improvement in serial memory tasks unlike those contained in the educational program[2],was evidenced by the Learning Games Group. This is a contrast to the negligible improvement in these same tasks evidenced by the other groups in the investigation.

At the completion of the study, only a selection from the vast amount of data was summarized. Thus it is probable that in the selection process, bias was evidenced just as it is highly probable that the feelings the investigators held about the worth of the learning games approach, contaminated their sessions with their instructors. The bias in turn may have unduly influenced their interactions with the children.[3] It is hoped that the general approach outlined in this report is thoroughly researched by others not in direct contact with those who originally expounded the basic rationale upon which the teaching methodology described within these paragraphs is based.

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[2] Repeating numbers in correct sequence after being given them verbally, and correctly ordering the pictures of animals which have been presented visually.

[3] Even a cursory pursual of Rosenthal's fine text of a few years ago, dealing with experimenter influences, was such a sobering experience for the senior author, that it was months before he could bring himself to confront a subject within an experimental context!

The validity of some of the other tests given, might also be questioned. However most of the others, including those evaluating spelling and letter recognition, we believe, can be said to have face validity. Indeed there are few other tests of letter recognition which could have been introduced into the study. In successfully completing the three tests used, a child had to; demonstrate the ability to remember a letter flashed visually and write it; verbally recite the alphabet in correct order; and verbally repeat the letters of the alphabet in random order when each letter was presented visually.

Furthermore, there is an increasing amount of evidence that letter recognition is supportive of later reading success. (5) Letter and pattern recognition have been shown to correlate significantly and positively (5) (14) with reading competency, while letter recognition scores obtained from poor and good readers within the elementary school grades have been found to differ significantly. (13). Some advocates of "sight reading" would argue otherwise, but there is reasonably good data emanating from a number of studies, that letters are the "building blocks" of words, and that the recognition of letter shapes is in many ways similar to the recognition of word shapes.

A final general consideration revolves around the specificity versus the generality of human attributes. In general, it was found that what was specifically taught was indeed learned by the children. Furthermore, during the time the children were stimulated by the extra attention in either of the two special tutoring groups, they most evidenced concomitant improvement in their classrooms.

A legitimate question revolves around the problem of whether the extra tutoring in these activities transfers to any other similar academic operations and secondly, of whether the extra stimulation within a single semester of the childrens' lives, evidenced any carry over in time. In answer to the first question, the experimenters were surprised to find that transfer from serial memory tasks in which total body movements were employed as stimuli, seemed to enhance serial memory abilities of other types of stimuli. In an effort was made to create as broad a "transfer width" as possible, when teaching letter recognition, a great variety of letter recognition games in a learning games context, were employed. In this latter case, transfer was not left to chance, but a variety of experiences was introduced. In the former case (serial memory), the other two types of serial memory tasks were avoided in the Learning Games Group in an effort to determine whether some generality of improvement of serial memory could be elicited.

Relative to the transfer in time of a stimulating learning experience of a single semester leading to a more enduring improvement, we have only teacher observations to depend upon at this time. In general, it was reported to us that some of the children were indeed uplifted rather permanently through their experiences in motivating learning games. Others (perhaps about an equal number) evidenced a "let down" following the termination of the experimental program. The investigation proposed as a follow-up for this one will attempt to look more closely at long term effects of the type offering extra attention to which children were exposed, within this program.

Overall, however, it is believed that the findings are quite promising. The children dealt with were the least-capable 3 to 6 youngsters in classes numbering from 45 to 50. Furthermore, many were those who had been excluded from special help because their scores were more than one grade below that expected of them. The duration of time, as has been pointed out, that these children were given extra attention in the form of apparently motivating games, was relatively brief each week.

PRACTICAL IMPLICATIONS

During the course of the program, many methodological problems arose, and in seeking their solution, several ways of better applying the various learning games became apparent. At the same time, ways of placing the learning games into a total educational context more efficiently, also were made clear as the study progressed. Program content was expanded during the latter stages of the project and more learning games were devised by the teachers and children. Most important, the need for close liason between the classroom teacher and the program's instructors also became obvious as the study reached its final stages. Improved ways of making equipment important to the program were devised. Various make-shift letter grids, composed of both immovable and portable letters, were constructed during the duration of the program.

In general, it was clear that in order for any kind of stimulation incorporating learning games to be most effective, close cooperation between the unique approaches of the regular classroom teacher and special "learning game" instructors, was needed. As a result of this study, weekly conferences are recommended between teachers of the regular classes and special instructors, during which characteristics and problems of individual children are reviewed. Only in this way will the various learning games be most effectively applied, and contribute most to the education of the children taking part.

Conferences of this nature will pinpoint, for example, the exact projects taking up regular class time, as well as the manner in which individual children may be lagging behind in certain skills. Conceivably, as a result of these conferences the institution of various learning games may be made more frequently during the school day or week, than the three-times-a-week, one-half hour class session schedule imposed in this program. Also as a result of this type of teacher-to-teacher cooperation, the individual children exposed to learning games might vary from week to week, and from day to day.

It also became apparent, as a result of this program, that highly individual programs should be devised for each grade level. The children in the first grade, for example, generally seemed to require extensive practice in impulse control activities, pattern recognition, and letter recognition. The children in the upper grades could concentrate more on spelling and letter recognition games in which the identification of script (written) letter forms is carried out.

It was further found during the pilot study that teaching spelling without reference to letter sounds was unrealistic. Thus, during the primary portion of the study, letter sounds were matched to letters and combinations of letters, via the Open Court Phonics method. It is believed that the improvement in spelling seen in some individual children, and in some sub-groups of children within the study, was largely attributable to this combination of phonics teaching and active learning games.

The immoble letter grids used in the pilot study were used initially in the main investigation. However, it soon became apparent that movable letters were more effective for three primary reasons. (a) If the letters were placed on individual squares, the children could initially concentrate upon making one or two discriminations while having only one or two letters in front of them, instead of attempting to pick up the correct letter from the twenty-six or more appearing on the original painted grids. (b) The movable letters permitted the use of various relay games in which they could be carried around by the children. And (c) in using the stable painted grids, it was found that some children would learn to identify letter names by using place cues. i.e. They were sometimes seen to learn the A because it was in the upper left hand corner of the grid rather than because of its unique conformations. On the other hand, using the movable letters, their location relative to each other and to the child, could frequently be changed, so that shape cues would be those most likely to be depended upon by the children, when attempting to identify the letters.

Working with the children in the pilot study and in the main part of the program also taught the instructors and program directors important principles dealing with transfer of training. It was found for example, that the children would not become able to write letters of the alphabet upon being shown them visually, unless actual writing practice was inserted into the program. It was also found important to give the children practice in the identification of both lower and upper case as well as script letters,so that bridges of understanding would be built between the various ways in which the letter A might appear.

Moreover, it was even found that the plane in which the letter resided had to be frequently changed, so that the child would recognize it, no matter whether it was resting on the floor or written on a vertical surface (the blackboard). After identification of the letter took place via jumping in it, the child was often asked to pick it up and hold it in a vertical plane, and then compare it to its match written on the blackboard

In general, when teaching letter recognition (and the same rules probably apply when teaching number and word recognition), it was found that an increase in difficulty would take place by modifying three basic variables within the method of presentation. (a) Increasing the number of discriminations made the problems more difficult. At first, some children had only one letter placed in front of them, and then were asked to jump into it when a letter which matched "their" letter was placed on the blackboard. Next, two letters were placed in this manner, and then three, etc., until all 26 letters were present and the child had to chose from among all of them when making his selection.[5]

(b) The method presentation by the instructor, when varied, would change the difficulty of the response given by the child. The easiest response occurred when the instructor both wrote the letter and also named it verbally. Next in order of difficulty was when the instructor would merely write the letter on the board, and finally the most difficult was when the instructor would, without any visual cue, name the letter verbally. Other researchers have similarly found that this continuum of presentation affects the difficulty of student response. (15) (56).

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[5] Using this criteria, one could make a good case for starting with pattern recognition and using five or six geometric figures, in working with immature normals and retarded children. When this is mastered, one can move on to the 26 discriminations required in letter identification, and finally to the hundreds of letter shapes needed to begin engagement with sight reading.

(c) A third dimension of the teaching situation which affected the difficulty of letter identification, was a temporal one. If the letter remained on the board while the child was trying to match it via for example, jumping in the appropriate square, the task was easiest. If the letter was first removed from sight and then the child was asked to respond, the problem became more difficult. Finally, when an increasingly longer time interval was introduced, the child had to depend upon auditory and/or visual memory and had an even more difficult problem in making the correct response. Unless the child engages in some kind of mental and/or subvocal or vocal rehearsal, according to the research, during the first minute of the time interval between the moment when the stimulus figure is removed and a response is required, it is unlikely that the letter will be remembered. Thus, when attempting to extend this time interval, the child should be instructed in this fact, and be taught to verbally and/or mentally rehearse the letter, number, or word he is later responsible for identifying via some kind of movement response.

Another teaching problem to which this program gave some tentative answers was the question of class size. The sizes of the classes, both in the Tutorial Group using a classroom, as well as in the Learning Games Groups, were of similar size. In general, it was found that as the semester wore on, the size of the Learning Games Group could vary from 6 to 12 children, and under the direction of a creative teacher, the impact of the learning games would not diminish. The question of class size, of course, depends upon many variables including the age and self-control of the children, as well as the competency of the teacher. In general, it is believed that if a well-structured program is prepared, the size of the Learning Games Group can be as large as 20 or 30 children, although groups of that size were not utilized in this investigation.

It had become increasingly apparent, as the study progressed, that the pattern recognition games were less than helpful to the children, unless specific practice in translating simple geometric patterns into letter shapes, was engaged in. It was found that learning the names of even the common geometric figures led nowhere, unless the children were shown how to change a triangle into an A, and half-circles into B's, etc. This transfer of simple shapes to letter shapes was accomplished using a blackboard, as well as via several types of learning games.

Teaching the children in this investigation, revealed a wide scope of potential activities which could be incorporated into the curriculum of children of a number of types. The implications for further research and curriculum experimentation seem limitless. Some of these possibilities are explored in the sections which follow.

The findings displayed in the previous chapter revealed no changes in the I.Q. scores on the part of the children in all four groups. This was not unexpected in so far as initial factor analysis revealed that the I.Q. scores were not related to the tasks reflecting academic competencies, specifically trained for the program described. At the same time, the qualities evaluated by the picture vocabulary test used (the Peabody) seem more related to the breadth of a child's life experiences, rather than to any basic learning potential. Thus, our data suggests that while specific academic competencies are improvable through the use of the learning games described, the child's ability to verbally identify objects from a wide range of categories is not markedly affected. One might therefore conclude that a child within the surroundings in which the program resided, should be given the opportunity to engage in two types of educational experiences. The first type are those which contain ways of improving specific and needed academic competences, and the second type should focus upon improved ways to understand a wider breadth of society than the child may have been exposed to within the narrow confines of his sub-culture.

IMPLICATIONS FOR FURTHER STUDY AND FOR EXPERIMENTAL CURRICULA.

The listing which follows includes only some of the possible ways in which the ideas emerging in this program might be expanded, and illuminated. It is hoped that further research by individuals critical of this approach will be undertaken. As has been stated, the commitment of the present investigators could certainly have biased the teaching methods utilized, the manner in which the data was collected, and also the ways in which the findings were presented. Among the more obvious approachs which might come out of this investigation, or which are presently planned as extensions of this program are: To concentrate upon first graders and pre-schoolers in a variety of pre-academic skills including pattern recognition, impulse control, letter identification, counting, and number identification. In this proposed extension of the present project, it is also planned to afford first grade children this type of program daily, for one-half hour a day, in close cooperation with their classroom teacher.

A second main avenue of study is to focus upon certain children within the middle elementary and upper elementary school grades. Games which incorporate reading, more difficult math processes, and social studies lessons including geography and the like, are presently being devised. An investigation of how they affect the performance of older children might be extremely helpful.

Although the children in this investigation possessed I.Q.'s which might label them as "dull normals", the investigation did not concentrate upon children whose mental capacities stamp them as truly retarded. The primary investigators have observed teachers in the Los Angeles area and in other parts of the country, working effectively with both educable and trainable retardates, while employing some of the learning games incorporated into this program. The Special Education Branch of the Los Angeles City Schools, as well as the Joseph P. Kennedy Jr. Foundation, are both encouraging the use of learning games of the type described on these pages, within their respective programs.[6]

The use of these types of games for gifted children could also be explored in further studies. The opportunities to create their own games might be extremely appealing to children of this type, some of whom, like the children in this study, may need some rather regular relief from the tensions created by immobility in a sometimes rigid classroom environment. Creative writing and higher mathematical operations can be acted out through movement games.

Numerous other types of children might benefit from the types of activities employed in this program. For example, the American Foundation for the Blind, in New York, is presently investigating this approach in the education of the partially-sighted youngster. It is believed by some connected with this Foundation, that the large stimuli involved, as well as the motivating nature of the activities, might indeed prove helpful to children whose sight is impaired. Further study, of course, is needed with this type of child before specific recommendations may be forthcoming.

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[6] An extensive demonstration of the games was given at a special evening meeting of parents and coaches at the Special Olympics in Chicago 1970, sponsored by the Joseph P. Kennedy Jr. Foundation. The learning games were used at Camp Shriver during the summer of 1970. The directors of the Foundation have expressed a desire to incorporate some of these types of activities directly into the Olympics during the coming years, and special learning events are presently being devised for them.

The emotionally disturbed, hyperactive youngster, as well as the too passive child, might also benefit from the games explored in this program. Hypothetically, the too active child may have been initially a child who was simply more active than normal, but not pathologically so. Attempts to confine such a child to a passive classroom environment might have elicited the hyperactivity he later evidenced. This hyperactivity is a behavioral tendency which might have been by-passed if initially he were exposed to active ways of learning, compatible with his basic movement needs.

On the other end of the continuum, the habitually "sleepy" child may be encouraged to become alert and to participate when the games are stimulating, and when he must activate himself to higher levels than usual in a classroom, while participating. Relative to this problem area, it may become possible to devise daily and weekly "maps of activation" for individual children or for groups of children, so that the opportune times for the insertion of both passive and active learning experiences might be plotted. The use of various physiological as well as psychological indices of activation and arousal might be helpful in the construction of such graphs.

Various basic research studies may also be carried out, for example, investigations of the personality type, physiological profile, and/or body type best suited to a learning games approach. Similarly, the personality and background of the teachers most likely to incorporate this type of approach into their lessons might also be the subject of further study.

SUMMARY

The data from this program, as well as observations emanating from contact with the children, resulted in several types of implications dealing with teaching methods, further research, and various general considerations.

Problems of the sequencing of activities and transfer of training, presented themselves in the course of the program. Some of these were solved, and the implications which arose from their solutions were outlined on the previous pages. Other problems await solution within further research programs of the type outlined on these pages.

A considerable amount of teaching for transfer was found necessary within the teaching program. Letters had to be spoken, written, and visually identified by the children, and then presented by instructors in many modes, in order to be effectively remembered and utilized by the children in other contexts.

Movable letters were found to be more helpful than the immovable grids. Other equipment modifications suggested themselves as the program progressed. Reading and mathematics games, as well as those in which even more creative attributes might be enhanced, also became apparent to the instructors while working with the children. Inter-grade, inter-sex, as well as inter-individual modifications of the techniques,also emerged from contact with the children.

Further research might deal with an expanded list of learning activities, as well as an expanded list of atypical children, including the partially-sighted, the emotionally disturbed, and the moderately retarded.

CHAPTER VI

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this program was to evaluate the effectiveness of active learning games in the enhancement of selected academic operations among Negro and Mexican-American children within the "Central City" of Los Angeles. The 127 children in the investigation were composed of first to fourth graders who were identified by teachers and by standard tests as evidencing academic achievement and potential one or more grade levels below what would be expected for children their ages. Many did not know all the letters of the alphabet, nor could they identify simple geometric figures. They could not read nor spell well. The average I.Q. (Lorge Thorndike) was about 85, while their classroom achievement was also considerably below what would be expected.

After two weeks of tests the children were exposed to one of four programs during an 18-week period. One group acted as controls and received no extra class tutoring or other special physical activity. A second group received a special program of physical education lasting 3 days a week (Monday, Wednesday and Friday) for a period of one-half hour each day. A third group received special small-group tutoring within a classroom (also three times a week, for one-half hour lessons) by an instructor trained for the project. A fourth group was exposed to a variety of sequenced learning games intended to promote self-control, increased attention, as well as specific academic operations including verbal letter and pattern recognition, the ability to write and recite the alphabet, spelling, and serial memory.

During the course of the 18-week semester, two series of 6 intermediate tests were given at 6-week intervals (one after 6 weeks, and one at 12 weeks) in order to ascertain the rate of progress, if any, of the four participating groups. The program was concluded with a second prolonged testing period lasting 12 weeks and including the 6 tests given twice during the semester, as well as the more extensive battery of tests given at the beginning of the program.

Instructors were regularly rotated between the groups, to control possible effects of teacher personality upon the performance measures taken.

The data emanating from the study resulted in the following findings:

1. The children in the Learning Games Group evidenced significantly quicker learning of the letters of the alphabet (by the 6th week) including the ability to write their letters and to recite them verbally in random order and in alphabetical order. This faster progress in these related abilities was found among the various grades, as well as among the poorest initial performers in the tasks of letter recognition.

2. The performance of the children in the Learning

Games Group was comparable to that of the children in the Special Classroom Tutoring Group, in final measures of pattern recognition.

3. In the measure of self-control, the children in the Learning Games Group evidenced more superior scores by the 12th week than did the children in the other groups.

4. No significant sex differences were uncovered in the data.

5. In the tests of serial memory, which were dissimilar to the training tasks involving serial memory (remembering the movements of another child), the children in the Learning Games Group evidenced scores superior to those of the children in the other groups.

6. The children in the Learning Games Group generally started with higher mean scores in the various tests, including spelling, however during the course of the study, as a group, they extended their lead over the children in the other groups.

7. Based upon the percentage of children in each group earning perfect scores in tests of letter recognition, the children in the Learning Games Group posted significantly higher scores than did the children in the other three groups, during the 6-week trend tests as well as during the final testing period. This superiority was found between the poorer initial scorers in each group, and between the first graders, as well as between the second, third, and fourth graders in each group.

8. A combined score of the motor ability items (balance, agility, etc.) was seen to improve more in the Learning Games Group than in the other three groups, during the semester.

9. No significant changes, by group, were noted for the scores in the Peabody Picture Vocabulary Test of I.Q., administered prior to and at the completion of the semester.

As a result of these findings it was concluded that use of active learning games can, if applied in the correct ways and to the proper children, have a beneficial effect upon selected academic operations.

Recommendations arising from this study revolve around improved teaching methodologies, improved equipment, and include recommendations for further investigations of a similar nature.

Teaching methodologies may be improved by careful attention to the individual needs of children confronted with learning games, and by attempting carefully to pair classroom experiences with those operations contained in the learning games. Movable letters were found more helpful than static grids containing letters. When planning spelling and letter recognition games, class sizes of 20 to 30 children may be possible.

Recommendations for further studies include the suggestion that children labeled retarded, gifted, partially-sighted, and emotionally disturbed might be utilized as subjects for a program of further investigation. Moreover, an expanded list of academic operations may be incorporated into the learning games presented to such children, including reading, geometry and higher mathematical operations, as well as creative writing.

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APPENDIX

TESTS

INSTRUCTIONS FOR BODY PERCEPTION, BALANCE, AND AGILITY TESTS (LEVELS I & II)

1. Test children individually using a well-lighted, obstruction free room (30 by 30 by 9 feet).

2. Only the testers should be present.

3. Administration time: 30 - 45 minutes, depending upon the ability of the child.

4. The tester is to describe verbally every test item. He then demonstrates exactly the way the child is to execute the movement. The tester may assist the desired movement, providing the test suggests assisting the child.

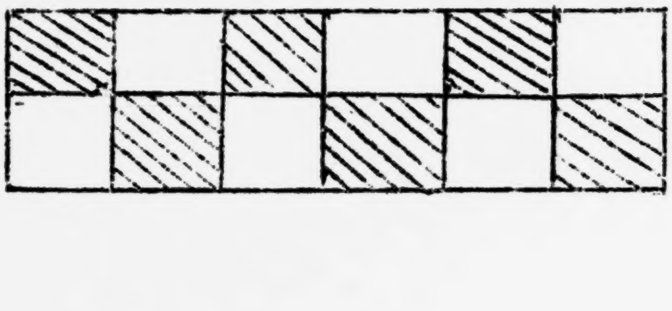
5. The tester must follow as closely as possible, the directions outlined for the administration of each test item. The tester should give encouragement to the child. If the child asks the tester how he is performing, the tester should positively re-enforce the child.

6. All test items in Level I are to be administered to each child. If his average score in Level I is 4.0, the tester should administer the test items in Level II. If any single test in Level I reaches a score of 5.0, he should be given the test item in the corresponding category of Level II.

7. The child should be brought into the room with the tester, introduced, and informed that "he will be playing some games with (the name of tester) for a few minutes." Avoid using the word,"test".

Equipment

*1. Mat - size 4' by 6' by 1 1/2"; Mat is divided into 12, one-foot squares; alternate squares are marked with diagonal lines. See illustration below;



(Instructions, continued)

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*Mat is style 806 from Paramore-Baier, 146 South Robertson Blvd., Los Angeles, 90048
Color - blue
Lines - made with 1" yellow tape No. 471
Mats have valero touch fasteners on the 6' sides to permit instant attachment.

2. Clipboard, scoring sheets, test battery, pencil, eraser, stopwatch.
3. List of children to be tested.
4. Pencils and paper for the children to use.
5. Table, two chairs.
6. Box of Kleenex.

TEST ADMINISTRATION

Test 1 - Body Perception (Level I)

Equipment: 4' by 6' mat

Preparation: Have the child stand on the floor with his toes against the mid-point on the four-foot edge of the mat. The tester should stand on the floor and beside the child.

Describe the movement for the child. If the child fails to comprehend the verbal directions, the tester should demonstrate the movement, and then ask the child to perform the movement. Thank the child after he has completed the movement.

Test Items:

1. (Name) ; lie down with your stomach (front) touching the mat, please. Point is scored regardless of where the child places his head relative to the tester.

2. Lie down with your back touching the mat.

3. Lie down with your stomach (front) touching the mat and nearest me. Before giving these directions, the tester should walk to the far side of the mat. Point is scored if his feet are toward the tester and if he is lying on his stomach.

4. Lie down with your side touching the mat. Point is scored regardless of the side selected.

5. Lie down with your left side touching the mat. This test item must not be demonstrated.

Scoring:

Maximum score: 5 points

One point is given for each correctly executed test item.

No points are deducted for a slowly executed response. Have the child rise after he has performed each test item.

Test 2 - Gross Agility (Level I)

Equipment: Mat, stopwatch.

Preparation: Have the child lie on his back in the middle of the mat with his feet toward the tester. The tester should stand at one end of the mat, approximately five feet from its edge.

Instructions: After the child is in position, the tester should say, "When I say the word, GO, I want to see how quickly you can stand on your feet facing me.

READY, GO

If the child fails to comprehend the directions, the tester should demonstrate the movement.

Start the stopwatch on the word, GO, and stop it when the child is on his feet and facing the tester.

Scoring:

Score	Action	Time Interval
1 point	Rolls on stomach, stands	3/seconds
2 points	Rolls on stomach, stands	2/seconds
3 points	No roll over, stands	3/seconds
4 points	No roll over, stands	2/seconds
5 points	Standing Position	1/second

Maximum Score: 5 points

Test 3 - Balance (Level I)

Equipment: Stopwatch

Preparation: Have the child stand on the floor, facing the tester, with a distance of ten feet between them. The tester should demonstrate the balance test by standing on his left foot for five or more seconds and using his arms to help him maintain his balance.

Instructions: Say to the child, "Which foot can you stand on for the longest period of time? You may use your arms to help you to hold your balance, but you may not move the foot you are using to balance. When I say, GO, lift one foot and hold your balance as long as you can until I say, STOP." (Permit the child to try either foot if he needs to do so. However, after he has decided on the foot he wishes to use, he must keep on that foot through the test.)

Scoring:

Score		Action		Time Interval
1 point	-	if balance is held for	-	1/second
2 points	-	if balance is held for	-	2-3/seconds
3 points	-	if balance is held for	-	4-5/seconds
4 points	-	if balance is held for	-	6/seconds

(Tester now demonstrates holding balance on the same foot, but with his arms folded across his chest.)

1 point - if balance is held with arms folded for 3-4/seconds

Maximum Score; 5 points

Test 4 - Locomotor Agility (Level I)

Equipment: Mat divided into 12 one-foot squares.

Preparation: Ask the child to stand on the floor at one end of the mat. The tester should be at the same end.

Instructions:

1. "Name , can you crawl down the mat like this?" Tester demonstrates by crawling down the mat away from the child, then turning and crawling toward the child. One point is scored if the child has a cross-extension crawl pattern.

2. "Name, walk down the mat like this." Tester walks down the mat and away from the child. One point is scored if the cross-extension pattern is evidenced in the gait. (If the tester is in doubt, have the child walk for a greater distance.)

3. "Can you jump down the mat like this?" Tester demonstrates taking three - four jumps, keeping both feet together and using the correct arm lift. One point is scored if the child is able to leave the ground for two or three jumps.

4. "Can you jump backward down the mat?" Tester demonstrates the backward jumping movement. One point is given if the child can jump backward two or three times without falling down. Child is permitted to look behind himself when he is executing this portion of the test.

Safety - The tester should position himself in such a way as to be able to catch the child should he lose his balance and fall backward.

5. "Are you able to hop down the mat on one foot?" The tester demonstrates the movement hopping down the mat away from the child. One point is scored if the child can hop on one foot (either foot) two or three times. Hop on the mat.

Scoring:

Maximum score: 5 points.

Test 1 - Body Perception (Level II)

Equipment: Mat

Preparation: The child is asked to lie on his back on the mat with his feet pointed toward the tester who is standing at one end of the mat.

Testing: The tester should say, "Name, I am going to ask you to do certain things with your arms and legs. Try to follow my directions as accurately and as quickly as you can. Keep your eyes closed until I tell you to open them."

1. "Raise your left arm in the air (upward)." Tester should wait until the child makes a decision and moves. "Put your arms down (lower your arm)."

2. "Raise your left leg." Tester should wait until the child decides on a movement and then moves. "Lower your leg to the mat."

3. "Raise your left arm in the air (upward)." Tester should wait for the decision and the action. "Lower your arm."

4. "Touch your left elbow with your right hand." The tester should wait for the child to make his decision and to move. "Put your hands at your sides."

5. "Touch your right knee with your left hand." "Open your eyes and stand."

Scoring:

Maximum score: 5 points

One point is given for each correctly executed movement. No points are deducted for slowly executed movements. If in numbers 1-5 the movements are correct, but they are done with the wrong body part...i.e. all movements are consistently reversed...the child is given a score of three points for this test.

Test 2 - Gross Agility (Level II)

Equipment: Mat

Preparation: The child is placed at one end of the mat. The tester stands at the opposite end, facing the child.

Testing: "Watch carefully while I show you what you are to do next. Without using my hands (hold hands away from his sides) I am going to kneel first on one knee, then kneel on the other knee, then stand on one foot, and then stand on the other foot. Would you like to have me do this again before you try to do what I did?"

If the child would like to see the movement demonstrated again, the tester repeats the movement, using four counts. He demonstrates the movement very slowly, about 1/sec. per movement.

"Are you ready? Now kneel, kneel, stand, and stand."

Scoring:

1 point - if the child touches his hands to his thighs and/or to the floor during the kneeling - standing action.

2 points -if the child touches one or both hands to his thighs during the kneeling - standing action; or

if he comes down on both knees at the same time; or

if he gets up by standing on both feet at the same time.

3 points -if he uses one or both hands while getting up only; or

if he falls to one knee while arising.

4 points -if he executes the movement without using his hands, but there is a general unsteadiness (i.e. extra steps taken as the child resumes his standing position.)

5 points -if he executes the movement perfectly.

Maximum score: 5 points

Test 3 - Balance (Level II)

Equipment: Stopwatch

Preparation: Place the child in a standing position on a level floor, with the tester standing ten feet from the child.

Safety - Make certain that the area is free of obstacles to prevent accidents in the event the child loses his balance and falls.

The tester demonstrates the position to be held by the child; i.e. the bending of the one knee, folding of arms.

Testing:

1. "I want to see how long you can stand on one foot with your arms folded like this. Hold the position until I say, Stop. You may not let your other foot touch the floor." Have child use his preferred foot for balancing. However, he must use the same foot for Items 1, 2, and 3.

2. "...stand on one foot, with your eyes closed, and your arms at your sides (arms at sides means the child may use his arms for maintaining his balance in any way that is helpful to him). Hold position until I say, Stop."

3. "...stand on one foot, fold arms, and close your eyes. Hold until I say, Stop."

4. "...stand on non-preferred foot, with your eyes closed, and your arms at your sides. Hold the position until I say, Stop."

5. "...stand on non-preferred foot, fold arms, and close eyes. Hold until I say, Stop."

Scoring:

Maximum score: 5 points

One point is scored for each of the five test items that are completed successfully. Balance must be held for 5 seconds for each test item.

No score is given if:
- arms become unfolded, when required to be folded;
- eyes are opened, when required to be closed;

- if the other foot touches the floor during the 5/sec. interval;
- if he lifts the foot on which he is balancing.

Allow some time for between trials resting (a few seconds).

Test 4 - Locomotor Agility (Level II)

Equipment: Mat divided into 12 one-foot squares.

Preparation: Child should stand on the floor, at one end of the mat, and face the tester who is standing at the opposite end of the mat.

Testing:

1. "Can you jump down the mat like this?" Tester demonstrates by jumping into each of the six squares, moving carefully and keeping both feet together. He moves in a straight line.

2. "Can you jump into the blue squares like this?" Tester demonstrates by jumping diagonally into the blue squares only, keeping both feet together.

3. "Can you jump backward into the squares?" Tester demonstrates by jumping backward into each of the six squares, keeping both feet together. He moves in a straight line. The child is permitted to look backward. The tester should be in a position to catch the child should he lose his balance.

4. "Can you hop into each square?" Tester demonstrates by hopping into each of the six squares. He moves in a straight line.

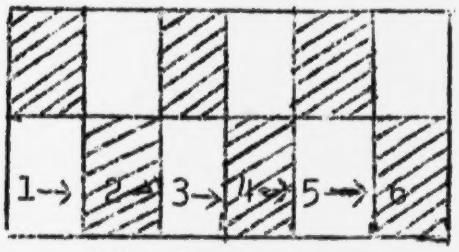
5. "Can you hop into the blue squares?" Tester demonstrates by hopping diagonally, using only the blue squares.

Scoring:

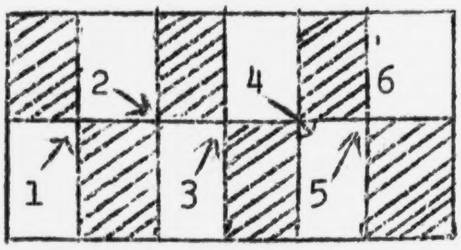
Maximum score: 5 points

Test 4 (Level II) Continued

One point is scored for each successful trip which consists of 4 correct responses out of a total of 6.



Straight line



Diagonal line

Errors:
- if one foot, or both, touch the borderline of a square.
- if the foot (or feet) does not land inside of the square.
- if when hopping, the other foot is touched.
- if an extra step is taken in a square to maintain balance.

PERSISTENCE

Equipment: A yellow line, 12 feet long and one inch wide, on the floor; a stopwatch.

Preparation: Have the child stand at one end of the line. The tester demonstrates to the child how and where he is to walk. Allow the child to take a few practice steps.

Testing: "I would like to see how slowly you can walk to the end of this line. At no time may you stop moving, you may not step off the line. However, if you should step off the line, do not stop, but continue to move as slowly as possible until you have reached the end of the line."

Scoring: 1. Clock the number of seconds it takes the child to walk to the end of the line.

PATTERN RECOGNITION

A. Visual

Equipment: Six 5" by 8" cards, each of which illustrates one of the following geometric designs: circle, square, triangle, rectangle, half-circle, diamond. The size of the figures is 4" by 4"; a blue figure on a white background. A table, two chairs, and a stopwatch. A sheet of paper having the same six designs printed on it. The six designs, 2 1/2" by 2 1/2", were drawn on a piece of paper 8 1/2" by 11".

Preparation: The child should be seated across the table from the tester. Place the piece of paper containing the designs on the table in front of the child.

Say: "I will show you one design, and after you have looked at it very carefully I will turn it face down on the table. I would like to have you point to a corresponding design on your paper. Do you understand the directions?" The tester holds the card in front of the child for two seconds. He then turns it face down on the table. The child points to the corresponding design within a two-second interval. The tester continues this procedure for the entire sequence.

Scoring: Maximum score: 6. One point is scored for each correct response.

B. Verbal

The equipment, preparation, and testing procedures remain the same for the verbal response section as they were for the visual response section. The only change in the procedure is the response on the part of the child. Instead of pointing to a corresponding design, he is required to tell the tester the name of the figure.

Scoring: Maximum score: 6. One point is scored for each correct response.

LETTER RECOGNITION

A. Verbal Response

Equipment: One complete alphabet of upper case

(Verbal Response continued.)

letters. Each letter of the alphabet is printed on a 5" by 8" card. The letters are black on a white background; dimensions of letters are 3" by 3". A table, two chairs and a stopwatch.

Preparation: Seat the child across the table from the tester so that the letter on the flash card will be clearly visible to the child. Shuffle the cards to avoid a sequential presentation of the alphabet. A random order, different from the one used in the pre-test,should be used for the post test.

Testing: "I shall show you a card with a letter of the alphabet printed on it. I would like you to tell me the name of the letter. Do you have any questions?" (Demonstrate if necessary.) Flash the letter-card at three-second intervals: the child is to respond with the name of the letter within a two-second interval.

Scoring: Maximum score: 26. Score one point for each correct response.

B. Written Response

Equipment: One complete alphabet of lower case letters. A table, two chairs, a stopwatch, a sheet of primary writing paper, and a pencil.

Preparation: Seat the child across the table from the tester. Give him a pencil and a sheet of paper. Present letters in random order.

Testing: "I will show you the letters of the alphabet once again, but this time I want you to say the name of the letter and write it on the piece of paper after I have turned the card face down on the table." Flash the card for three seconds; turn the card face down; the child is to respond verbally and to write the letter on the paper within a three-second interval.

Scoring: Maximum score: 26. Score one point for each correctly written letter.

C. Verbal and Movement Response

Equipment: Upper case letters on cards, and table.

(Verbal and Movement Response, continued)

Preparation: Have the child stand facing the cards.

Testing: "Can you say the alphabet for me?" Permit the child to recall the alphabet in sequence. Child should be standing and point to correct letters in order.

(Grades 3-4: Use the same procedure but substitute the cursive upper and lower case letters for the manuscript letters.)

Scoring: Maximum score: 26 points. Score one point for each correct response.

SERIAL MEMORY

A. Auditory Memory

Equipment: Table and two chairs.

Preparation: Seat the child across the table from the tester.

Testing: "I will say three numbers to you. Remember carefully and after I have finished, I want you to tell me the numbers in exactly the same order as I said them to you. Each time I do this, I will add one more number. I want you to repeat the numbers in exactly the same way that I have said them."

Give the child three numbers in random order. Give the numbers at 3-second intervals. Add one number each time until the total sequence has eight numbers.

Scoring; Maximum score: 8 points, for repetition of all 8 numbers. Perfect memory of 5 = 5 points, etc.

B. Visual Memory

Equipment: Table and two chairs. Individual 5" by 8" cards with the following letters:

Card 1 - A Z P
Card 2 - A Z P Q
Card 3 - A Z P Q B
Card 4 - A Z P Q B D
Card 5 - A Z P Q B D M
Card 6 - A Z P Q B D M G

Preparation: Seat the child across the table from the tester.

Testing: "I will show you 3 letters. Remember them carefully, and after I place the card down on the table, I want you to tell me the letters in the same order I showed them to you. Each time I will add one more letter. I want you to repeat the letters in exactly the same way I have given them to you."

Flash the letters at 3-second intervals using the random order already established. Hold the cards tilted to avoid glare. Begin with three letters at 3-second intervals, placing each face down on the table after holding it up. Add one letter each time until the total sequence has 8 letters.

Scoring: Maximum score: 8 points, as in section A.

C. Visual and Motor Memory

Equipment: Tape geometric designs of a circle, square, diamond, and rectangle on the floor using yellow masking tape. Dimensions should be:

Circle - 4' diameter
Square - 4' by 4'
Diamond - 4' by 4'
Rectangle - 6' by 4'

Preparation: Place the child facing tester at a distance of 6 feet.

Testing: "I am going to make three different movements. Watch me very carefully, because after I have completed the third movement, I want you to do them for me in exactly the same way." (Have child imitate movements.) "This time I am going to make four different movements. Watch me very carefully, because after I have completed the fourth movement, I want you to do them for me in exactly the same way." (Have child imitate four movements.)

Continue in this manner, adding one configuration each time until you have completed the 8 patterns.

Patterns are:
1) Walk to circle;
2) Jump in it one time;
3) Walk to square;

(Visual and Motor Memory, continued)

1-2-3-4) Jump in square two times
1-2-3-4-5) Hop to rectangle
1-2-3-4-5-6) Touch each corner of the rectangle with your hand (use either hand)
1-2-3-4-5-6-7) Skip to the diamond
1-2-3-4-5-6-7-8) Walk on the lines that form the diamond shape

Scoring: Maximum score: 8 points.

Test 5 - Spelling

Equipment: Table and two chairs. A pencil and lined primary paper for the child. Numbers from one to twenty are written on the paper.

Preparation: Seat the child across the table from tester.

Testing: "I will give you a word and I would like to have you write it for me on the paper I have given you. If you do not know how to spell the word, then leave that space empty and move to the next number on your sheet of paper." Dictate the words at spaced intervals, allowing the child sufficient time to write the word. If he does not seem to understand the word, use it in a sentence so he can get the meaning of the word.

The spelling words to be dictated are:

He
She
It
I
Me
Go
The
And
Here
Come
Stop
Play
Boat
Made
Morning
Began
Animal
Children
Beautiful
Laugh

Scoring: Maximum score: 20 points

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* Spelling words used were from the *Dolch Basic Word List*, and the *Stanford Achievement Test for Primary I*. (Edited by Harcourt, Brace, 1966 Edition.)